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A FOLLOW-UP STUDY ON POSTOPERATIVE SPEECH OF CLEFT PALATE CHILDREN*

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Introduction

It is true that the speech of cleft palate children after surgery has been significantly improved in recent years. This improvement is due to several factors such as an appropriate selection of age for the palatal repair, and progress in the surgical and anesthetic techniques. However, as a recent survey has indicated (Spriesterbach et al. 1973; Morris, 1973), 20 to 30% of these patients are still left with poor speech and/or deficient velopharyngeal function. This means that to rescue those unsuccessful cases, the postoperative speech of the children should be carefully followed up by the speech clinician with cooperation of the surgeon even if the surgery was apparently done in an appropriate way at an appropriate age.

In this paper, we report a follow-up study on speech in 75 cleft palate children operated on at ages from one to three. The follow-up was performed in the speech clinic of the Department of Otolaryngology, University of Tokyo.

Care Program

We first outline our program for taking care of the postoperative children in our speech clinic. They are examined regularly at intervals of 3 or 6 months postoperatively. The examination involves evaluation of organic conditions of the mouth including velopharyngeal closure and that of speech articulation.

Velopharyngeal closure is examined by visual inspection, measuring nasal air leakage in blowing, and auditory evaluation of hypernasality and nasal emission. In some cases lateral X-ray pictures are taken.

Examination of speech consists of a short screening test of language development and of several kinds of articulation tests. In the cases of young children where the prepared materials for the articulation test are not useful, speech materials consisting of free conversation, play, singing, and tape recorded samples in the children's homes are gathered for evaluation.

After this follow-up examination, indications for further treatment such as reoperation for velopharyngeal function, and speech training, are discussed by speech clinicians and speech-oriented otolaryngologists. Cooperation with other specialities – plastic surgery, pediatrics, dentistry and child psychiatry, for example – is also available when necessary.

For children less than four years old, no specific speech training is indicated other than giving a general consultation to their parents. In the consultation, the importance of the speech environment in the home, and the general velar activities of blowing, chewing, sucking and swallowing are emphasized. After the age of four, speech training is indicated for the

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children with faulty habits of articulation without poor velopharyngeal closure. The training is basically identical to the individual articulation training described in a text book (Van Riper, 1963). Secondary operation for the velopharyngeal function is performed any time when indicated, with an interval of at least one year between the surgeries. In our experience, the children without any articulation disorders with normal speech development at 3 years of age can be said to have achieved normal speech and later development of defective speech due to the cleft palate is quite unlikely.

For all the cases including those of reoperation and speech training, the target of our program at present is to finish all necessary treatment with the result of normal speech before the age of six, the school age.

Subjects

The seventy-five cases presented in this paper are those followed up for a period of one to five years after surgery. They are divided into two major groups.

Sixty-three cases in one group are those who achieved successful velopharyngeal function after the first surgery, and 12 cases are those who underwent repeated surgeries because of unsuccessful results. All of the 63 cases were operated on in the otolaryngology or plastic surgery departments of the University of Tokyo, or in the related hospitals, with modified Wordill's method(Omori et al., 1962). Among the 12 cases of the second group, five were operated on from the start in the clinics just mentioned.

Patients in the first group are further classified into 3 categories: the first is a group of 44 cases under our follow-up program throughout their course (regular group); the second is that of 14 cases who were not seen at surgery but were later referred to our program because of articulation disorders (additional group); and the third is that of 5 cases with mental retardation affecting their speech development (mentally retarded). The composition of the group of cases under this study is summarized in Tables 1 and 2.

Successful surgery	Age of surgery (months) 12-23	24-35	36-47	Total
Regular group	29	13	2	44
Additional group	11	2	1	14
Mentally Retarded	1	2	2	5
Total	41	17	5	63
Repeated surgery				12

Table 1: Composition of the groups of cases.

	Successful surgery	Repeated surgery	Total
Complete cleft	26	8	34
Postalveolar cleft	33	4	37
Submucous cleft	4	0	4
Total	63	12	75

Table 2: Types of the cleft.

Results

Cases of successful surgery:

In the regular group, 36 (82%) out of 44 cases acquired normal speech, 5 are still under observation and 3 in speech training. In the additional group, 9 out of 14 cases acquired normal speech and 5 are in speech training. There are many cases, even among those with now-normal speech, who showed articulation disorders during thier courses. In Table 3, findings in articulation tests for the regular group are summarized. Fifteen

Table 3: Types and distribution of articulatory disorders.

	Age of Surgery (months)			
	12-23	24-35	36-47	Total
A. D. (-)	14	1	0	15
A. D. (+)	15	12	2	29
H. R.	3	2	0	5
H. R. + A. E.	4	8	2	14
A. E.	8	2	0	10
Total	29	13	2	44

H. R. : hyper-rhinolalia, A. E. : articulation error.

34 % out of 44 cases showed no articulation disorder throughout their course. All of them except one case, had their palate repaired before the age of 24 months of age and showed articulation disorders during their course. In both groups the age at surgery ranged from 12 to 22 months and no difference in the distribution pattern was found. Among the speech disorders, hyper-rhinolalia (hypernasality and nasal emission) was found in 7 (24%) out of 29 cases operated on before 24 months of age, but in 10 (77%) out of 13 operated on at the age of 24-35 months, the same disorder was apparent. The difference between these two groups is statistically significant at the level of 0. 001. In the additional cases, only 2 among the 14 cases showed hyper-rhinolalia. Figure 1 shows the time course of hyper-rhinolalia in the regular group. In cases 1 to 5, hyper-rhinolalia was not noted at the time of surgery but appeared later. In cases

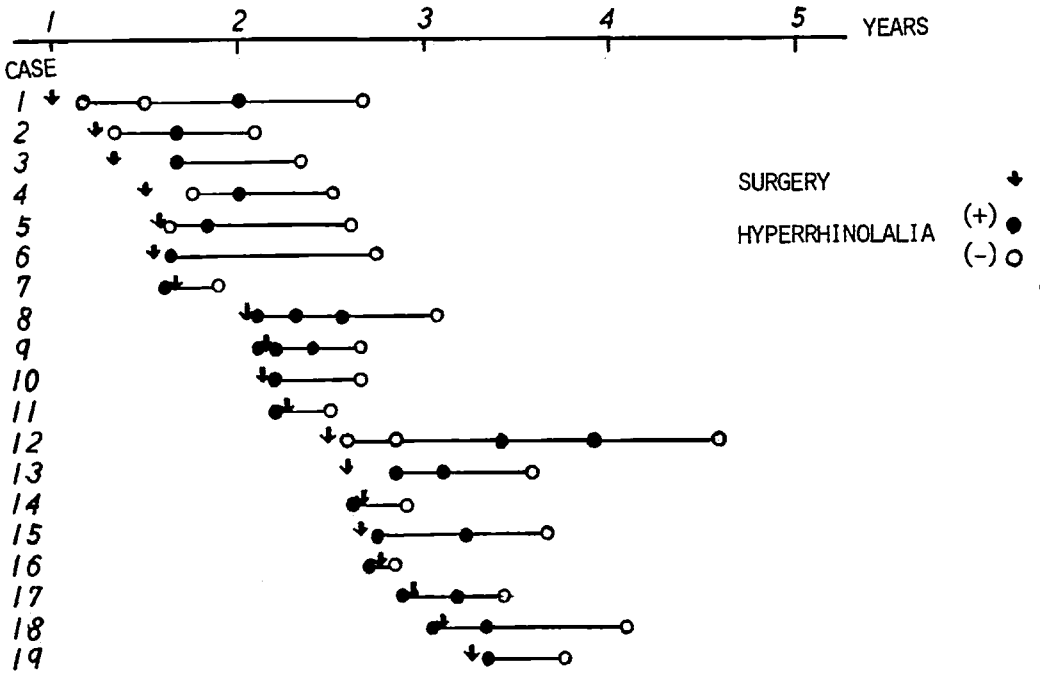

Fig. 1: Onset and prognosis of the hyperrhinolalia.

6 to 19, all but one (case 12) showed hyper-rhinolalia at the time of surgery. According to this figure, hyper-rhinolalia appears to be manifest from the age of 18 months until the age of 30 months. The hyper-rhinolalia then disappears spontaneously within 12 months after surgery. Case 12 shows the onset of the hyper-rhinolalia at 3 years of age. This unusual delay may be explained by the fact that this case had a considerable delay in articulatory development until the child reached a normal level in the 4th year of age.

Articulation errors (faulty habits of articulation) were found in 24 (55%) of the 44 cases: 12 (41%) out of 29 cases in the 11 to 23 month age group and 10 (77%) of 13 cases in the 24 to 35 month age group (Table 3). The difference in the incidence between the two age groups is statistically significant at the level of 0. 05. Some of those articulation errors were corrected spontaneously but the others were subjected to speech training, as shown in Table 4. In this table we note that once the articulation errors are manifested there is no difference in the possibility of spontaneous correction between the two age groups. Types of the articulation errors and their distributions are showin in Table 5.

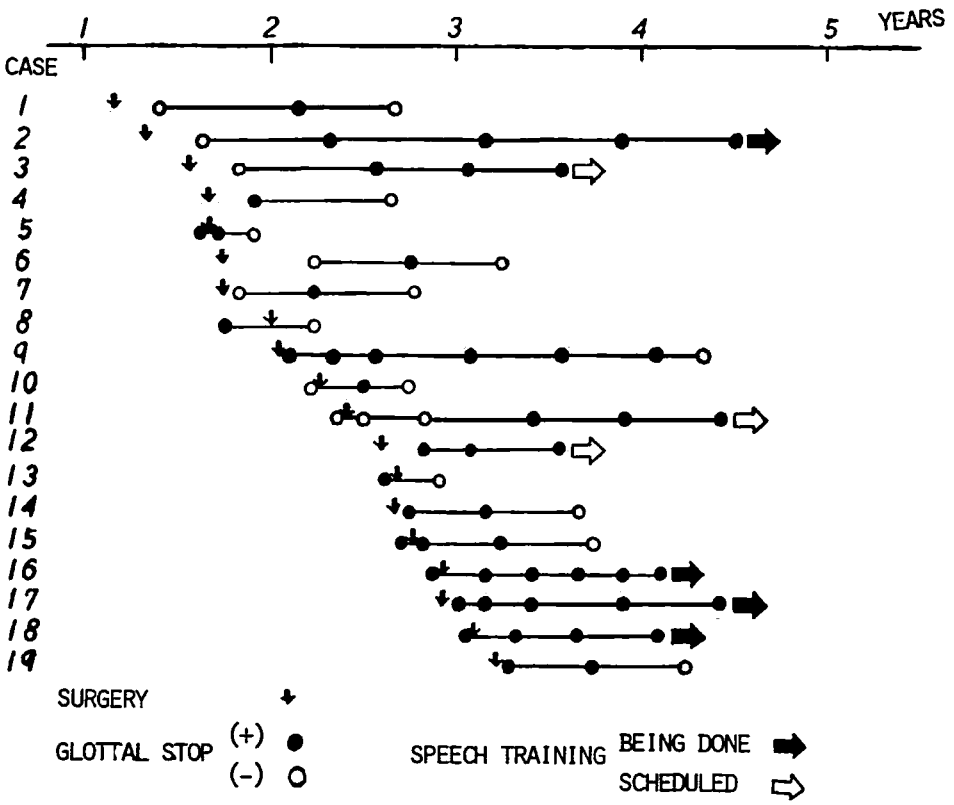

Fig. 2: Onset and prognosis of the glottal stop.

The "nasal articulation" in Table 5 is a particular type of articulation error which occurs for the vowels [i], [u] and some non-labial obstruents. The result of the error is a breathy nasal sound with complete closure within the oral cavity. This type of error was manifested at 24 to 30 months of age and corrected spontaneously before 4 years of age.

Cases with mental retardation:

All of the 5 cases were examined by the child psychiatrist and their IQ's ranged from 60 to 80. A delayed language development was found for all the cases in our screening test. Four cases acquired normal articulation, and two were subjected to speech training. A characteristic feature in the course of postoperative articulation in this group is a delayed onset of hyper-rhinolalia (37-44 months). The glottal stop and the palatal articulation were not seen in this group either, though the number of cases was very small.

Table 4: Prognosis of articulation errors

	Regular group (months)				Additional group (months)			
	12-23	24-35	36-47	Total	12-23	24-35	36-47	Total
Sp. Cor.	7	6	1	14	5	0	0	5
S. T.	5	4	1	10	6	2	1	9
Total	12	10	2	24	11	2	1	14

Sp. Cor. : spontaneous correction; S. T. : speech training.

Table 5: Articulation errors

	Regular group (months)				Additional group (months)			
	12-23	24-35	36-47	Total	12-23	24-35	36-47	Total
G. S	7	10	2	19	4	0	1	5
P. A.	3	1	0	4	3	2	0	5
N. A.	3	0	0	3	2	0	0	2
Others	0	1	0	1	2	0	0	2
Total	13	12	2	27	11	2	1	14

G. S.: glottal stop; P. A.: palatal articulation; N. A.: nasal articulation.

Substitution of the glottal stop for various obstruents, a most frequent and characteristic articulation error in cleft palate speech, was seen in 7 (24%) out of 29 cases operated on before 24 months of age, and in 10 (77%) out of 13 cases operated on in the 24-35 months range. The difference between the two is statistically significant at the level of 0. 001. Onset and course of the glottal stop in the regular group is shown in Fig. 2. In cases 1 to 10, the glottal stop appears to be manifested postoperatively very often, but the others show the glottal stop before or at the time of surgery. From the figure, it may be said that the glottal stop is manifested at ages from 18 to 30 months. Case 11 in this figure, who showed very late onset of the glottal stop, is identical to case No. 12 in Fig. 1. There are 12 cases where the error was corrected spontaneously, most frequently before 35 months and hardly ever after 4 years of age.

The articulation error labeled as the "palatal articulation" in Table 5, is not identical to the "palatalization " which occurs normally for the dental consonants followed by /i/ in Japnnese. In the palatal articulation here, the dental sounds are produced with the tongue body instead of the tongue tip or blade, making the articulatory contact with the hard palate instead of the teeth or the alveolar region. This type of articulation error was manifested from 30 to 36 months of age, although all of the 9 cases showing the error were operated on before 24 months of age. Among these cases, 7 were complete cleft palate, showing malocclusion or abnormality in the dental arch. In all of the 9 cases except 2, the error was not corrected spontaneously and was subjected to speech therapy.

Cases with repeated surgery:

Twelve cases were subjected to repeated surgery. The course of the treatment was quite different, case by case. Surgical procedures applied were the push-back operation in most cases, the pharyngeal flap operation in 2 cases, and the closure of the palatal fistula in 2 cases. Articulation disorders were seen in all the cases. There are 6 cases with whom adequate velopharyngeal closure was accomplished before 36 months of age. Among these children, hyper-rhinolalia was noted for 5 cases, but it disappeared within one year after the final surgery. The glottal stop was seen in 3 cases (out of 6) and corrected spontaneously in two of them. These patterns are nearly identical to those observed in the group with successful surgery.

In the other 6 cases undergoing repeated surgery, sufficient velopharyngeal closure was achieved after 36 months of age or still to be achieved at the time of the present survey. All of them showed the glottal stop as well as the hyper-rhinolalia. The other finding to be noted in these 12 children is that the palatal articulation was seen in nearly half (five) of the cases. Of these 5 cases, all except one were instances of complete cleft palate, showing abnormalities in the dental arch and occlusion. No spontaneous correction was observed for the palatal articulation.

Discussion

There seems to be general agreement that a better speech result is accomplished in cleft palate children when the palatal surgery is done before 24 months of age (Morley, 1970). Even so, there may be further argument that a superior speech result should be expected from surgery at an even earlier age. For example, Spriestersbach et al. (1973), in their extensive survey of cleft palate problems, summed up as follows: "While most surgeons in North America and Western Europe believe that this should be done prior to the age of 18 to 20 months, perhaps there is further advantage to closure prior to this time." Theoretically speaking, there may be no reason to oppose their comment just quoted. In practice, however, we need more clinical data on this point as these authors themselves also stated. As far as our data on post-operative speech are concerned, approximately half of the children having their palate repaired before the age of 24 months showed no articulation disorders, but almost no such cases were found in children operated on after that age. In this sense, it can be said that the former group showed a definitely better postoperative course than the latter. Within the group operated on before 24 months of age, however, we found no such correlation between the speech result and the age of surgery. Our conclusion at present is that better speech should be expected from surgery before the age of 24 months as compared to that after 24 months, but before 24 months the speech results may be more dependent on the status of individual speech (articulatory) development than on the calendar age at the surgery.

It should be noted that, even in the children operated on successfully before 24 months of age, there are 12 cases (approximately 40%) out of 29 who developed faulty habits of articulation postoperatively. Among them, 5 cases were subjected to speech training later on. This implies that even

successful surgery before the age of 24 months cannot always guarantee spontaneous development of normal articulation.

Manifestation of articulation disorders due to cleft palate seems to be closely related to the speech development, especially to that of verbal output. The hyper-rhinolalia was manifested at the age of 18 to 30 months. This type of disorder disappeared spontaneously within one year after the successful operation. In other words, a significant hypernasality with nasal emission remaining more than one year after surgery indicates the necessity of further treatment, i. e., a secondary operation for velopharyngeal incompetence.

The glottal stop was developed at 18 to 30 months of age, and the nasal articulation at 24 to 30 months. The palatal articulation was developed later at 30 to 36 months. This particular type of articulation error was mostly seen in complete cleft palate cases with dental anomalies, irrespective of the age of surgery. The development of these articulation errors appears to follow the same time course as the normal sounds which are replaced by the misarticulations. Spontaneous correction of nasal articulation was seen in all the cases. The glottal stop was also corrected spontaneously in more than half of the cases with successful surgery. Spontaneous correction in this type of misarticulation was seen most frequently before the age of 36 months and hardly ever after 4 years. Only two out of 14 cases having the palatal articulation showed spontaneous correction. Late onset of this type of misarticulation as well as orgainic condition of the maxilla may be related to its resistance to spontaneous correction. More study is necessary on this particular type of error. The postoperative speech course of the children with mental retardation may be said to show a pattern similar to that of normal children when their retardation in speech development is taken into account. Judging on the basis of speech development, all of these children were operated on at a fairly early stage, probably equivalent to earlier than 24 months in the children without mental retardation.

There have been many reports describing the glottal stop and the pharyngeal fricative as typical misarticulations in cleft palate speech. In our present study, however, none of the children showed the pharyngeal fricative. Another type of error, the palatal articulation, was observed instead. This difference is probably due to the lowered age of palatal repair as compared with previous studies. The pharyngeal fricative is typically used as a substitute for [s] and [ʃ]. In most of our present cases, velopharyngeal closure was accomplished before the age of acquisition of those sounds. A similar change in the pattern of the cleft palate speech, if not exactly identical, was reported by Green (1960) and Morley (1970). The importance of palatal articulation in the cleft palate speech is also emphasized by Okazaki et al. (1975).

The principle of the palatal repair is to achieve a competent velopharyngeal closure by the first operation. With present surgical techniques, however, there are still some children left with unsuccessful results. For those cases a secondary operation before the age of 36 months should be recommended. On the other hand, our results reveal that the indication of the secondary operation can be best established one year after the first surgery. Also, a one year interval between the surgeries is probably the minimum requirement from the view-point of tissue recovery from the

surgical trauma. Taking this into account, the first surgery before the age of 24 months should be recommended here also.

Conclusions

Postoperative speech was followed up on 75 cleft palate children during the period of one to five years after surgery. The results are summarized as follows:

1) Cases of successful palatal repair

i) About one half of the cases repaired before 24 months of age showed no deviation in speech throughout the course of observation, while most of the cases repaired after this age showed articulation disorders.

ii) Manifestation of articulation disorders appeared to be closely related to speech (articulatory) development of the children. The hyper-rhinolalia and the glottal stop were observed less frequently with cases where the palatal repair was performed at a lower age.

iii) The hyper-rhinolalia, which becomes manifest at the age of 18 to 30 months, is a direct reflection of the velopharyngeal function, and disappeared spontaneously within a year after the operation.

iv) The glottal stop, the nasal articulation, and the palatal articulation (use of the body of the tongue instead of the tip or blade, making the articulatory contact with the palate instead of the teeth or the alveolar region) were noted as faulty articulations and were manifest at the age of 18 to 30 months, 24 to 30 months, and 30 to 36 months, respectively. Spontaneous postoperative recovery was observed in the nasal articulation and the glottal stop, but not in the palatalized articulation.

v) From the point of view of speech development, the speech of the mentally retarded children showed a pattern similar to that of the non-retarded children.

vi) There was no case with the pharyngeal fricative articulation which is mentioned in earlier reports. Instead, the palatal articulation was noted in the present cases, especially those with the complete cleft. This seems to be a new pattern of cleft palate speech where the palatal repair is done early in childhood. This type of faulty articulation appears to be more difficult to correct by training than the glottal stop.

2) Twelve cases underwent repeated surgery after unsuccessful palatal repairs. All of them manifested articulation disorders regardless of the age of the first surgery. The speech was fairly good in cases where a satisfactory velopharyngeal function was achieved by the age of 3 years.

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