STUDIA PHONOLOGICA XXII (1988)

A Comparative Study of the Articulatory Development of a Normal Infant and Infants with Cleft Palate

Sei NAKAZIMA, Nobuko HIRANO, Miyuki INOUE, Michio KAWANO,
Kyoko KUNIYOSHI, Keiko MITAMURA, Hiromi OKAWA

I. INTRODUCTION

We have reported the following observations of normal infants in previous articles (Nakazima, S., 1962, 1966, 1970, 1972, 1973, 1974, 1975). At about 1 month of age, infants begin to utter calm sounds at the babbling level, then develop and organize their babbling phonatory-articulatory-auditory mechanisms, and articulate almost every speech sound of their mother tongue, except some fricatives, e. g. [s], [z], [ɕ], [ʑ], by the end of their repetitive babbling periods, i. e. about 8 months. They begin to use meaningful words from about 1 year. From about 1 year and 6 months, they begin to develop their phonemicization-symbolization processes, i. e. they begin to articulate vowels and consonants in their mother tongue phonemical system.

Observing articulatory development in infants with cleft palate (Kajino, H. *et al.*, 1982,, Kugo, S. *et al.*, 1981, Nakazima, S. *et al.*, 1986), we have reported that both in the process of articulatory development of meaningless and meaningful speech sounds, infants with cleft palate did not articulate most of dentals or alveolars and articulated palatals instead.

In this article, we are going to observe:

1) the process of articulatory development in a normal infant, in order to make clear whether or not the normal infant shows the same process of articulatory development as that in infants with cleft palate mentioned above, whether or not we should correct our previous observations on normal infants.

2) the process of articulatory development in infants with cleft soft palate and in infants with cleft lip and palate, in order to make clear whether or not the process of articulatory development in infants with cleft soft palate is different from that in

Sei NAKAZIMA, Ph. D. (中島 誠): Emeritus Professor, Department of Psychology, Kyoto University.
Nobuko HIRANO (平野信子): Psychologist, Educational Service Room, Setagaya Ward, Tokyo.
Miyuki INOUE (井上 幸): Speech Therapist, Medical Center for Children, Moriyama, Shiga.
Michio KAWANO (川野通夫): Assistant Professor, Division of Otorhinolaryngology, School of Medicine, Kyoto University.
Kyoko KUNIYOSHI (国吉京子): Speech Therapist, Institute for Mentally Retarded Children, Ikeda, Osaka.
Keiko MITAMURA (三田村啓子): Research Fellow, Division of Otorhinolaryngology, School of Medicine, Kyoto University.
Hiromi OKAWA (大川博美): Former Research Fellow, Department of Psychology, Kyoto University.

infants with cleft lip and palate.

II. PROCEDURES

As shown in Table 1, there were five subjects.

Table 1. Subjects and recording conditions.

Subjects	Recording (Year : Month)	Palatoplasty (Year : Month)	Beginning of Meaningful Words (Year : Month)
S. O.: a normal girl	0 : 2→2 : 6		1 : 1
Case A : a boy with cleft soft palate	0 : 6→2 : 7	1 : 1	1 : 2
Case B : a girl with cleft soft palate	1 : 1→2 : 7	1 : 9	1 : 3
Case C : a boy with cleft lip and palate	0 : 11→2 : 6	1 : 2	1 : 1
Case D : a girl with cleft lip and palate	1 : 1→2 : 5	1 : 6	1 : 1

S. O. : a female infant who is normal in physical and mental development. We asked her parents to record her speech sounds by a taperecorder at home, once a month. Each recording lasted about 15 minutes. Her speech sounds were recorded from the age of 2 months to 2 years and 6 months (Hirano, N. *et al.*, 1989).

Case A : a male infant with cleft soft palate. He underwent palatoplasty at the age of 1 year and 1 month. His speech sounds were recorded from 6 months to 2 years and 7 months.

Case B : a female infant with cleft soft palate. She underwent palatoplasty at the age of 1 year and 9 months. Her speech sounds were recorded from 1 year and 1 month to 2 years and 7 months.

Case C : a male infant with cleft lip and palate. He underwent palatoplasty at the age of 1 year and 2 months. Her speech sounds were recorded from 11 months to 2 years and 6 months.

Case D : a female infant with cleft lip and palate. She underwent palatoplasty at the age of 1 year and 6 months. Her speech sounds were recorded from 1 year and 1 month to 2 years and 5 months.

Speech sounds of case A, B, C, and D were recorded by a taperecorder at the Kyoto University Hospital and at their homes (Kuniyoshi, K. *et al.*, 1989).

We reproduced speech sounds of five subjects and transcribed them.

III. RESULTS AND DISCUSSION

The following were our observations :

1. Development of articulation in the normal infant.

1) Increase in number of speech sounds articulated.

We counted the number of speech sounds articulated by S. O. See Fig. 1. The vertical line shows the number of speech sounds which she articulated during the period of 15 minutes. The horizontal line shows her age. Circles show the number of her meaningless speech sounds and triangles show the number of her meaningful speech sounds. Solid lines show the periods during which her speech sounds were recorded every month. Dashed lines show the period during which her speech sounds were not recorded.

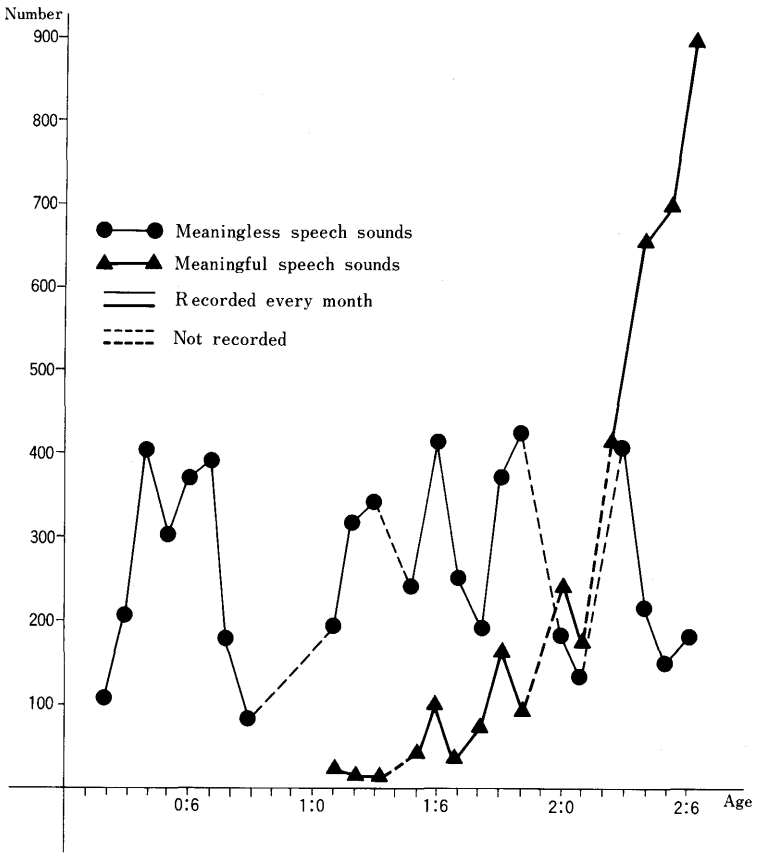

Fig. 1. Number of meaningless and meaningful speech sounds articulated by the normal infant. (for 15 minutes)

Number of her meaningless speech sounds varied from 100 to 400, i. e. from a few to many.

She began to utter meaningful speech sounds at 1 year and 1 month. At that time the number of her meaningful speech sounds was about 20 per 15 minutes.

From 1 year and 6 months, the number increased. At 2 years and 6 months the number reached about 900.

2) Development of articulation of meaningless speech sounds.

See Fig. 2. The vertical line shows the classification of speech sounds by the points of articulation and the types of articulation. The upper portion of each line shows voiceless, the lower voiced. The horizontal line shows her age. We counted the number of each speech sound articulated by her for 15 minutes. The dotted areas represent number from 1 to 4 (few), the slashed areas from 5 to 26 (moderate), and the blackened areas over 30 (many).

From 2 months on she uttered many glottal plosives [ʔ].

At about 3-4 months she uttered some velars, i. e. nasals [ŋ], plosives [k], [g], and fricatives [ɣ]. These sounds seemed to be produced when the back part of her vocal tract was closed by chance.

Then she began her repetitive babbling period and articulated various speech sounds actively.

At first, at about 5-7 month, she articulated some bilabials, i. e. nasals [m], plosives [p], [b]. She opened and closed her mouth repeatedly and produced these speech sounds actively.

Next, she began to use her tongue to articulate nasals, plosives, fricatives, and affricates. At first she could not move her tongue differentiatedly and moved it rather as a whole. She touched her hard palate and alveolar with the middle part of her tongue. At about 6-8 months, she articulated some palatals, i. e. nasals [ɲ], plosives [c], [ɟ]. And at about 6-8 months, she articulated some alveolo-palatals, i. e. affricates [tɕ], [dʑ].

Then, she differentiated her tongue movement at the back of her mouth and touched her soft palate with the back part of her tongue. From about 1 year on she once again articulated some velars, i. e. nasals [ŋ], plosives [k], [g].

At last, she differentiated her tongue movement at the front and touched her teeth or alveolar ridge with the front part of her tongue. After 1 year and 6 months, she articulated dentals or alveolars, i. e. some plosives [t], and after 2 years some other plosives [d].

Her repetitive babbling period was from 5 to 8 months. During this period she articulated a few velar plosives [k], [g], and a few dentals or alveolars, i. e. nasals [n], plosives [t], [d]. She articulated some palatals, i.e. nasals [ɲ], plosives [c], [ɟ], instead. In formar articles, described previously, we have stated that infants articulated almost every speech sound of their mother tongue, except some fricatives, by the end of their repetitive babbling period. We think that we mistook some palatals as velars, others as dentals or alveolars. As a matter of fact, some palatals are very similar to velars, others to dentals or alveolars.

We would like to correct our earlier observations and say as follows:

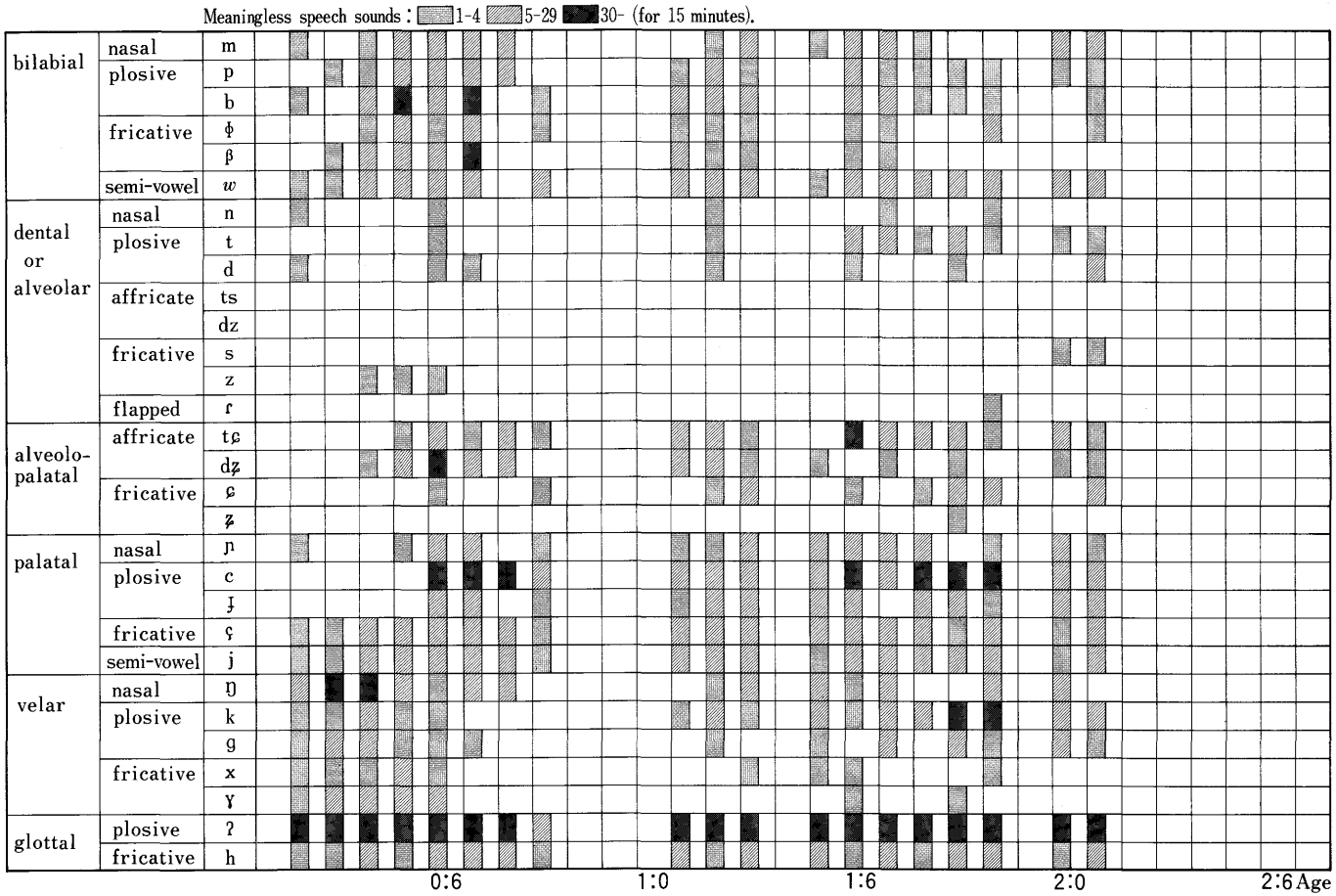

Fig. 2. Development of articulation of meaningless speech sounds articulated by the normal infant. (for 15 minutes)

During her repetitive babbling period, the infant articulated some bilabials, palatals, and alveolo-palatals. In this period the articulatory movement of her tongue was not differentiated. She articulated a few velars and dentals or alveolars. After this period the articulatory movement of her tongue differentiated. And after 1 year she articulated some velars, and after 1 year and 6 months some dentals or alveolars.

3) Development of articulation of meaningful speech sounds.

We show both the developmental process of her articulation of meaningless and meaningful speech sounds in Fig. 3. Signs are the same as those in Fig. 2. The first half of each month shows meaningless speech sounds, last half meaningful speech sounds.

She began to use meaningful words from 1 year and 1 month.

From the beginning of her meaningful speech sounds on, she still sometimes articulated some glottal plosives [ʔ].

After 1 year and 6 months, she articulated some bilabials, i.e. nasals [m], plosives [p], [b]. As for meaningless speech sounds, she articulated some bilabials from about 6 months. Almost 1 year later, she began to articulate bilabials of meaningful speech sounds.

As for palatals, from 1 year and 5 months, she articulated some voiceless plosives [c], from 1 year and 7 months articulated some nasals [ɲ], and from 2 years articulated some voiced plosives [ɟ].

As for alveolo-palatals, from 1 year and 5 months, she articulated some voiceless affricates [tɕ], and from 2 years and 1 month articulated some voiced affricates [dʑ].

She articulated palatals and alveolo-palatals of meaningless speech sounds at 6-8 months. Then almost 1 year or more later, she began to articulate palatals and alveolo-palatals of meaningful speech sounds.

As for velars, from 1 year and 8 months, she articulated some voiceless plosives [k], from 1 year and 10 months articulated some voiced plosives [g], and from 2 years articulated some nasals [ŋ].

She articulated velars of meaningless speech sounds from 1 year and 2 months. Almost 6 months later, she began to articulate velars of meaningful speech sounds.

As for dentals or alveolars, from 2 years she articulated some voiceless plosives [t], from 2 years and 1 month articulated some nasals [n], and from 2 years and 3 months articulated some voiced plosives [d].

She articulated dentals or alveolars of meaningless speech sounds from about 1 year and 6 months. Almost 6 month later, she began to articulate dentals or alveolars of meaningful speech sounds.

Our observations were as follows:

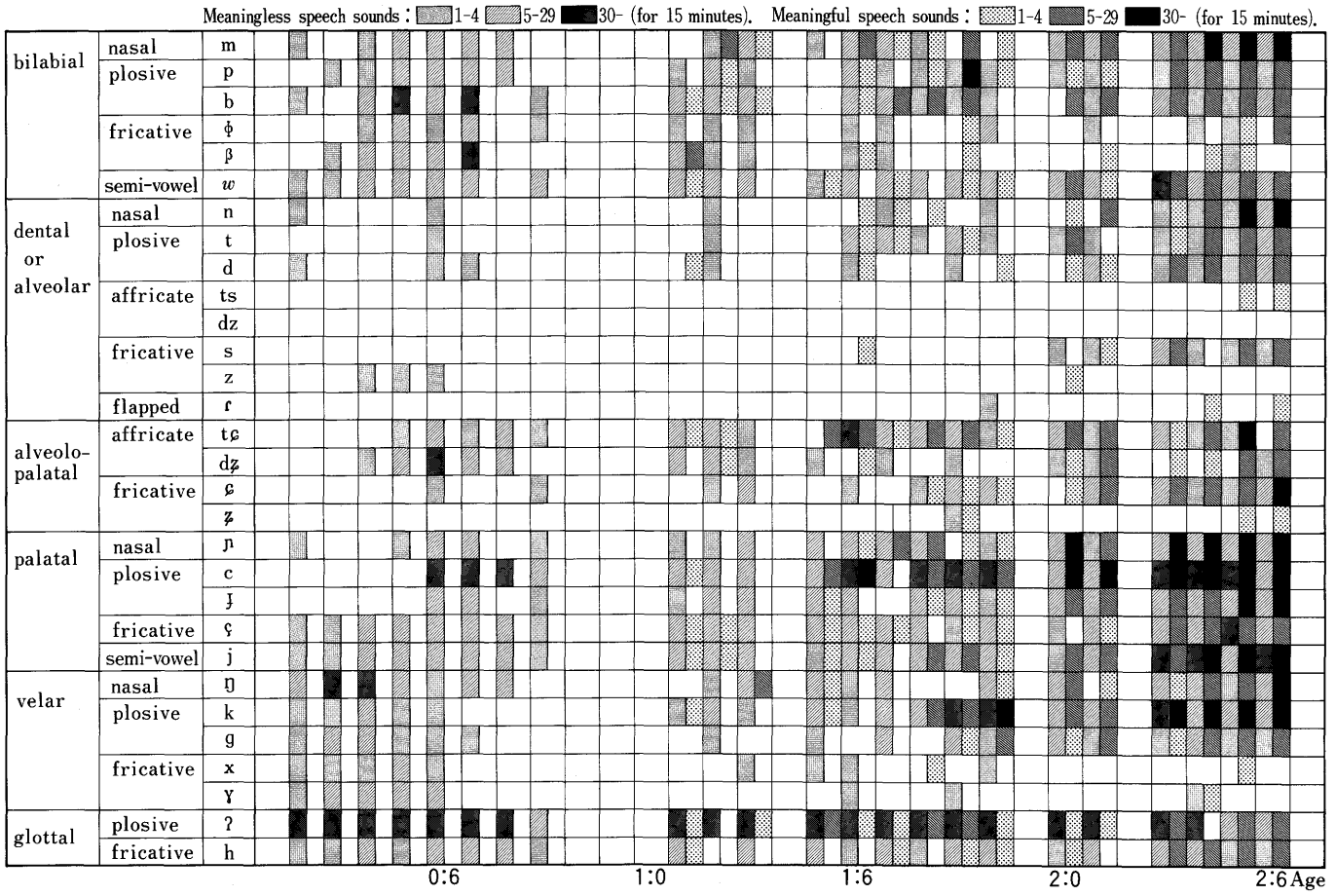

Fig. 3. Development of articulation of meaningless and meaningful speech sounds articulated by the normal infant. (for 15 minutes)

From about 1 year the infant began to use meaningful words. From about 1 year and 6 months, like other infants, she began to develop her phonemicization-symbolization process, i. e. she began to articulate consonants in her mother tongue phonemical system. From the early period of her phonemicization process, she articulated bilabials. At that period she articulated palatals, and alveolo-palatals in place of velars and dentals or alveolars. Then after 1 year and 8 months, she articulated velars, and after 2 years articulated dentals or alveolars. The developmental process of her tongue articulatory movement of meaningful speech sounds was the same as that of meaningless speech sounds.

Almost 1 year after beginning to articulate meaningless bilabials, palatals, alveolo-palatals, she articulated these speech sounds as meaningful, and almost 6 months after beginning to articulate meaningless velars, dentals or alveolars, she articulated these speech sounds as meaningful.

2. Development of articulation in infants with cleft palate.

1) Increase in number of speech sounds articulated.

See Fig. 4. Fig. 4-1, case A: a male infant with cleft soft palate; Fig. 4-2, case B: a female infant with cleft soft palate; Fig. 4-3, case C: a male infant with cleft lip and palate; Fig, 4-4, case D: a female infant with cleft lip and palate. Signs are the same as those in Fig. 1.

The numbers of their meaningless speech sounds varied from 50 to 700, i. e. from only a few to many.

After 1 year, they began to use meaningful words. The numbers of their meaningful speech sounds increased after 1 year and 6 months, especially after 2 years.

As far as these data are concerned, we did not find any difference either between the normal infant and infants with cleft palate, or between infants with cleft soft palate and infants with cleft lip and palate. However, at about 2 years and 6 months, while the number of meaningful speech sounds articulated by the normal infant reached about 900, the number of those articulated by infants with cleft palate reached about 600 or less.

2) Development of articulation of meaningless speech souads. See Fig. 5. Fig. 5-1, case A: a male infant with cleft soft palate; Fig. 5-2, case B: a female infant with cleft soft palate; Fig. 5-3, case C: a male infant with cleft lip and palate; Fig. 5-4, case D: a female infant with cleft lip and palate. Signs are the same as those in Fig. 3.

Case A: a male infant with cleft soft palate. Before plalatoplasty, at 6 months, he uttered many bilabial nasals [m], some velar nasals [ŋ], velar plosives [k], velar fricatives [x], [ɣ], and many glottal plosives [ʔ].

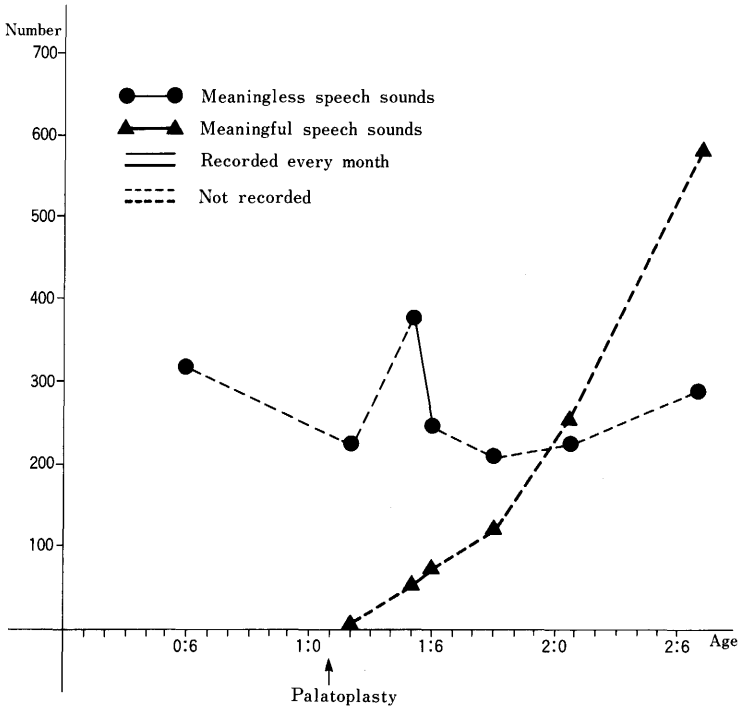

Fig. 4-1. Number of meaningless and meaningful speech sounds articulated by case A : a male infant with cleft soft palate. (for 15 minutes)

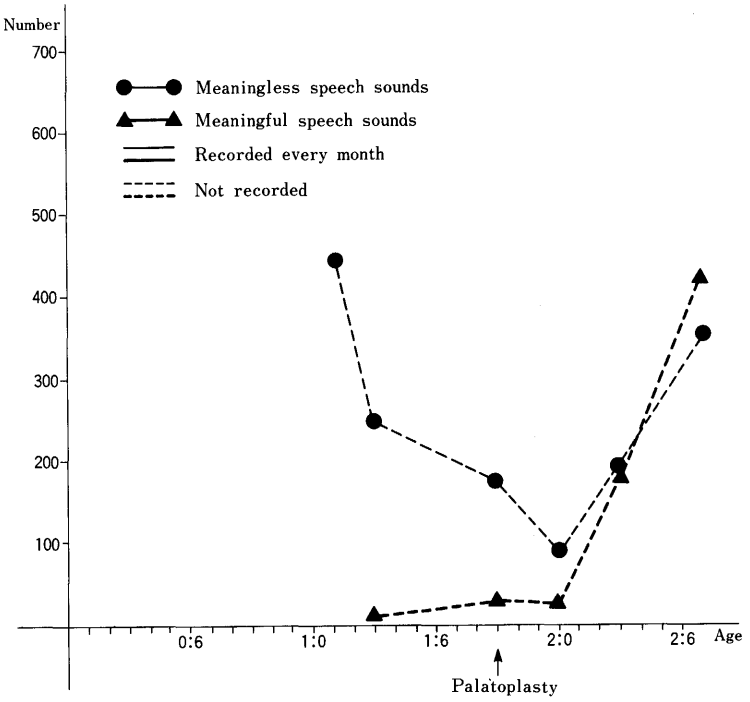

Fig. 4-2. Number of meaningless and meaningful speech sounds articulated by case B : a female infant with cleft soft palate. (for 15 minutes)

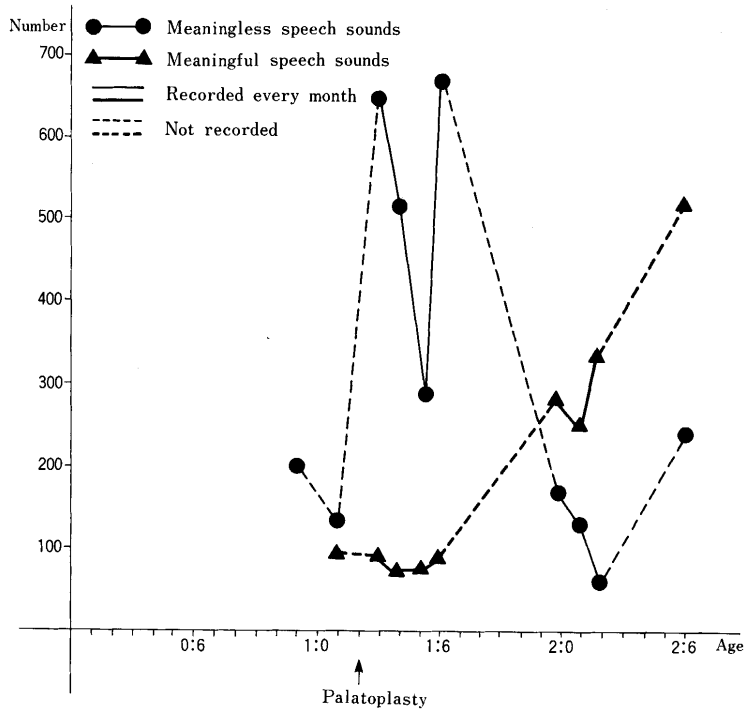

Fig. 4-3. Number of meaningless and meaningful speech sounds articulated by case C : a male infant with cleft lip and palate. (for 15 minutes)

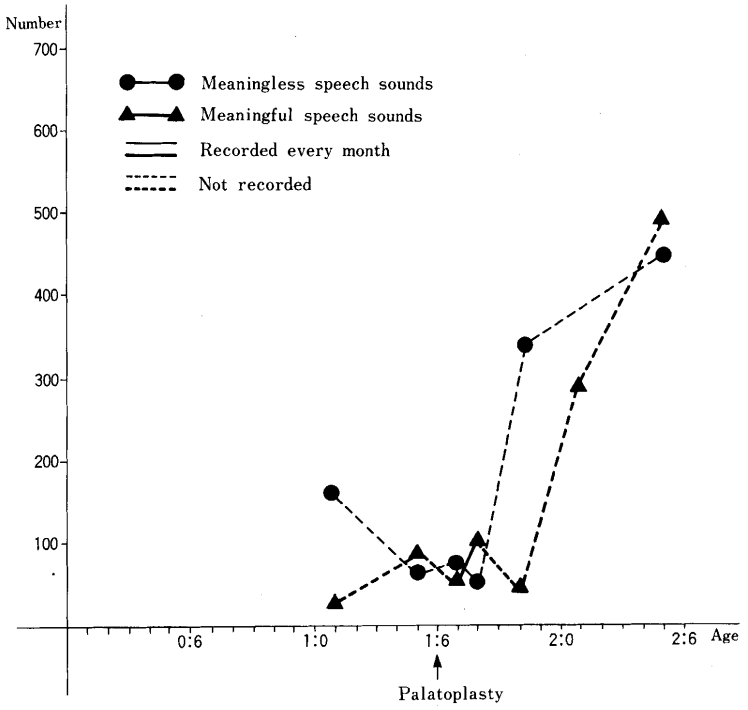

Fig. 4-4. Number of meaningless and meaningful speech sounds articulated by case D : a female infant with cleft lip and palate. (for 15 minutes)

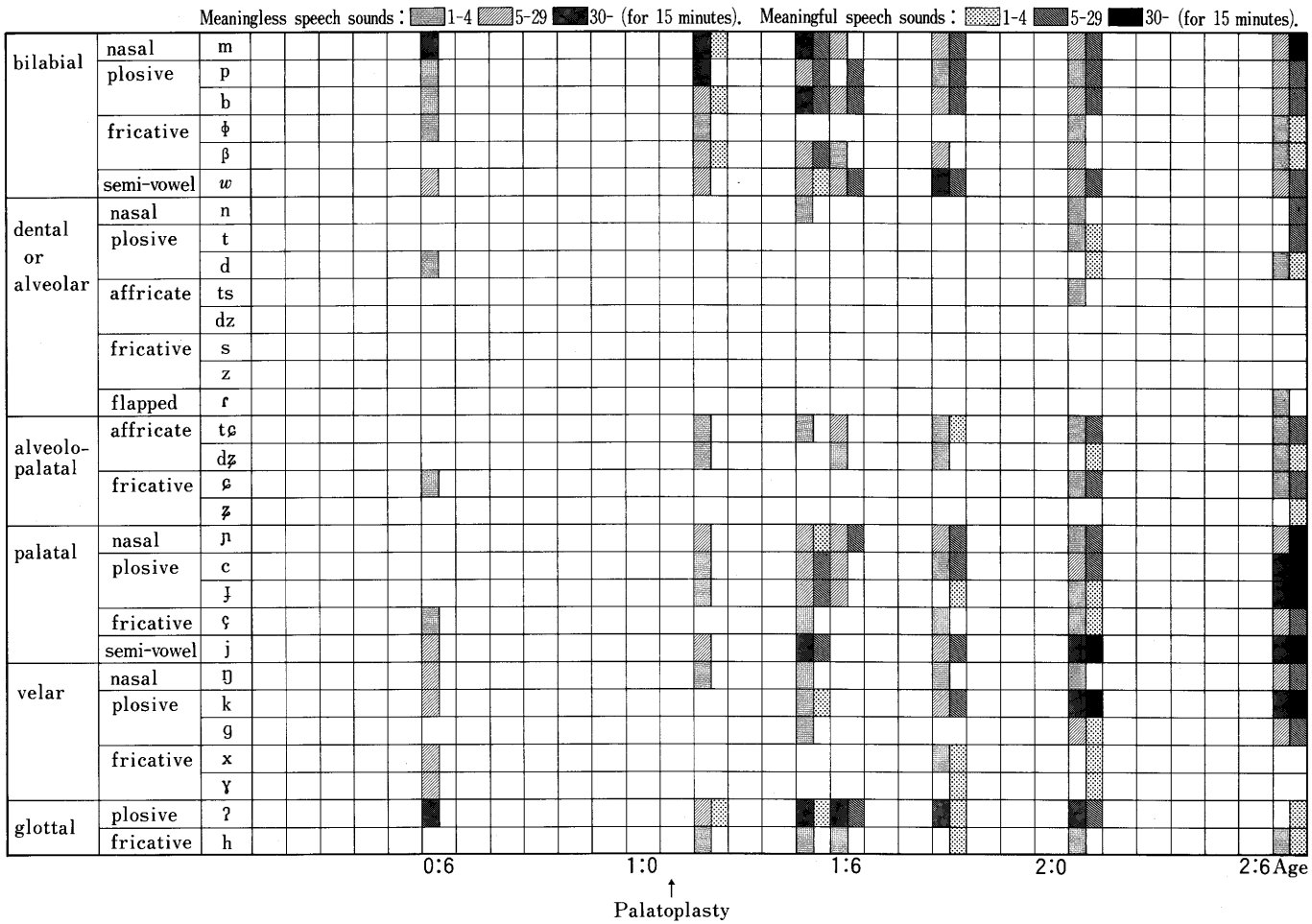

Fig. 5-1. Development of articulation of meaningless and meaningful speech sounds articulated by case A : a male infant with cleft soft palate. (for 15 minutes)

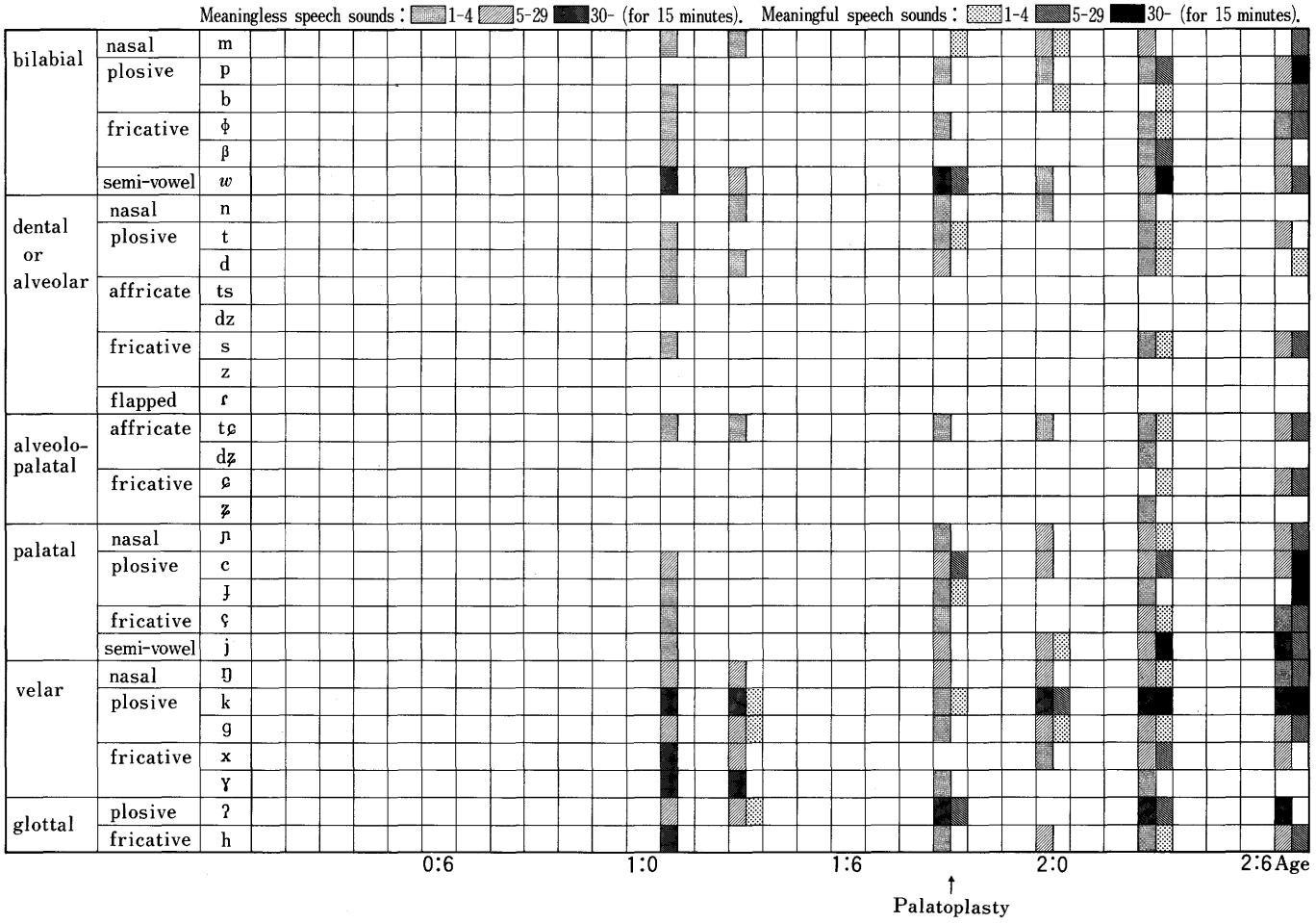

Fig. 5-2. Development of articulation of meaningless and meaningful speech sounds articulated by case B : a female infant with cleft soft palate. (for 15 minutes)

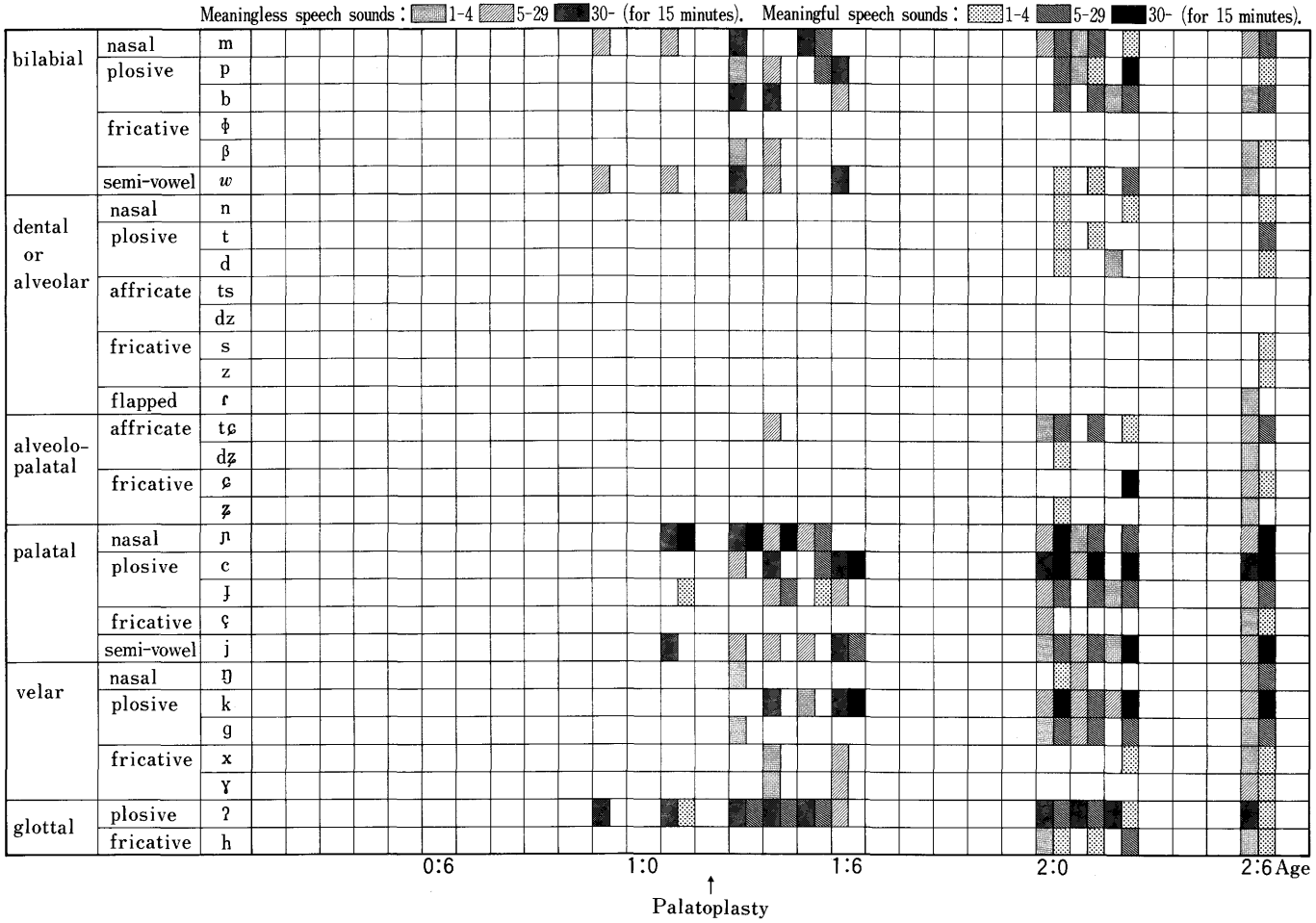

Fig. 5-3. Development of articulation of meaningless and meaningful speech sounds articulated by case C : a male infant with cleft lip and palate. (for 15 minutes)

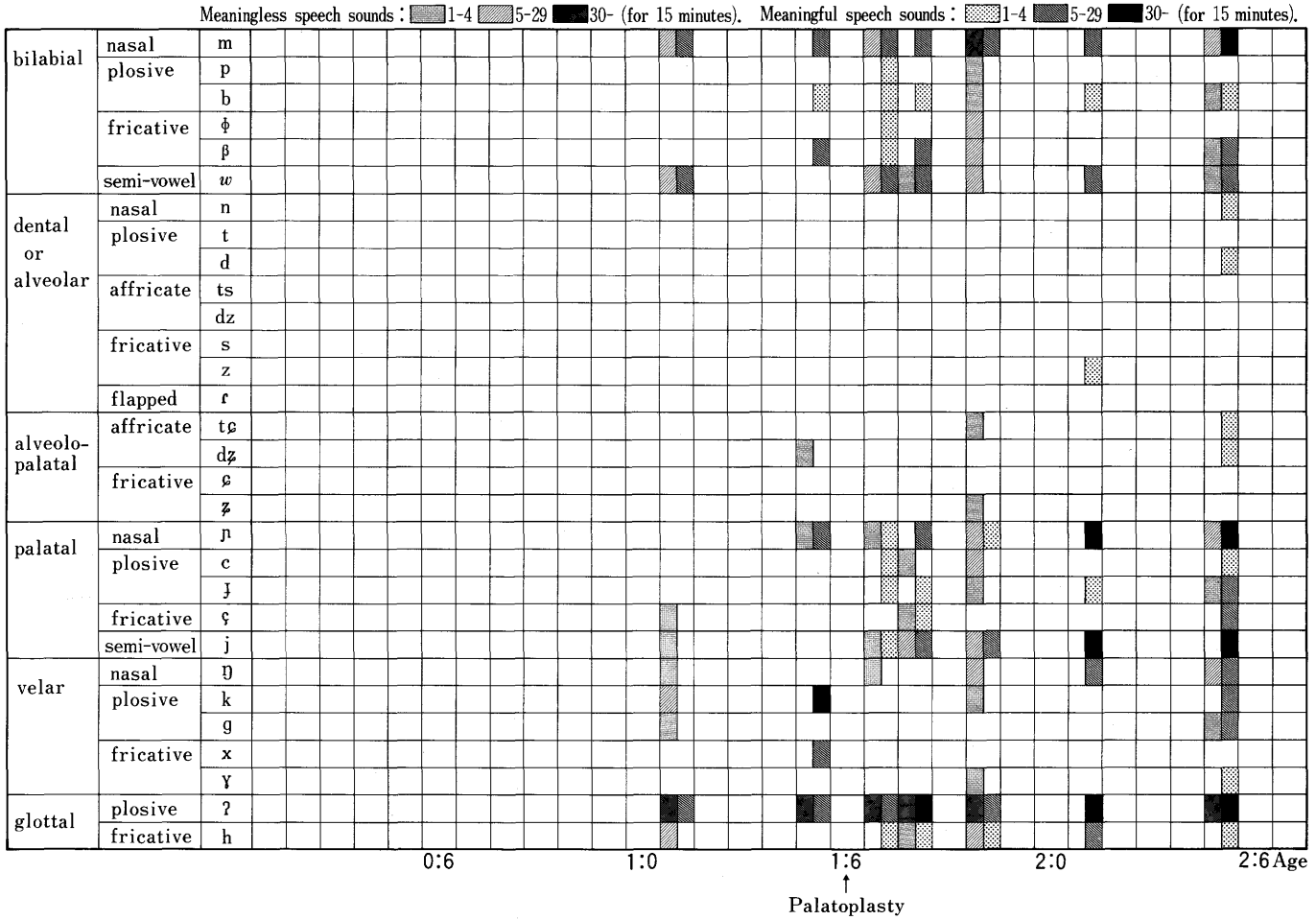

Fig. 5-4. Development of articulation of meaningless and meaningful speech sounds articulated by case D : a female infant with cleft lip and palate. (for 15 minutes)

He underwent palatoplasty at 1 year and 1 month.

1 month after the operation, from 1 year and 2 months, he articulated many bilabial plosives [p], [b].

From 1 year and 5 months, he articulated some palatals, i. e. nasals [ɲ],plosives [c], [ɟ], at 1 year and 6 months, some alveolo-palatal affricates [tɕ].

From 1 year and 9 months, he articulated some velars, i.e. plosives [k], [g] once again.

Even at 2 years and 7 months, he did not articulate dentals or alveolars.

Case B : a female infant with cleft soft palate. Before palatoplasty, at 1 year and 1 month, she uttered some palatal plosives [c], some velars, i. e. nasals [ŋ], plosives [k], [g], fricatives [x], [ɣ], and some glottal plosives [ʔ].

She underwent palatoplasty at 1 year and 9 months.

Just after the operation, at 1 year and 9 months, she articulated some dental or alveolar plosives [d], some palatal plosives [c], and some velar nasals [ŋ]. At 2 years, she articulated some bilabial nasals [m], and some palatal nasals [ɲ], and at that time articulated some velar plosives [k], [g] once again. At 2 years and 7 months, she articulated some bilabial plosives [p], [b], some alveolo-palatal affricates [tɕ], and some dental or alveolar plosives [t].

Case C : a male infant with cleft lip and palate. Before palatoplasty, at 11 months, he uttered some bilabial nasals [m], and many glottal plosives [ʔ].

He underwent palatoplasty at 1 year and 2 months.

One to two months after the operation, at 1 year and 3-4 months, he articulated some bilabials, i. e. nasals [m], plosives [p], [b], some palatals, i. e. nasals [ɲ], plosives [c], [ɟ], some alveolo-palatal affricates [tɕ], and some velar plosives [k]. At 2 years and 1 month, he articulated some velars, i. e. nasals [ŋ], and plosives [g]. But even at 2 years and 6 months, he did not articulate dentals or alveolars.

Case D : a female infant with cleft lip and palate. Before palatoplasty, at 1 year and 1 month, she uttered some bilabial nasals [m], some velar plosives [k], and many glottal plosives [ʔ].

She underwent palatoplasty at 1 year and 6 months.

1 month after the operation, at 1 year and 7 months, she articulated some bilabial nasals [m], and many glottal plosives [ʔ]. At 1 year and 10 months, she articulated some palatals, i. e. nasals [ɲ], plosives [c], and some velar nasals [ŋ]. Even at 2 years and 5 months, she did not articulate bilabial plosives [p], [b], dentals or alveolars [n], [t], [d].

As for case A, B, and C, before palatoplasty, some of them uttered bilabial nasals [m], palatal nasals [ɲ], velar nasals [ŋ], velar plosives [k], [g], and glottal plosives [ʔ]. After the operation, they articulated bilabial plosives [p], [b], palatal plosives [c] ([ɟ]), alveolo-palatal affricates [tɕ], and articulated velar plosives [k], [g] again. Most of them, at 2 years and 6 months, did not articulate dental

or alveolar plosives [t], [d].

We observed that infants with cleft palate began their articulatory development of meaningless speech sounds after palatoplasty and followed almost the same developmental process as that of the normal infant. They, at first, articulated bilabials, and almost at the same time articulated palatals and alveolo-palatals, followed by velars. Most of them could not articulate dentals or alveolars at 2 years and 6 months. We did not find any difference between case A, B, and Case C.

As for case D, she seemed to have incompetence in velopharyngeal function.

3) Development of articulation of meaningful speech sounds.

See Fig. 5. Case A: a male infant with cleft soft palate (Fig. 5-1). He began to use meaningful words from 1 year and 2 months. 4-5 months after palatoplasty, at 1 year and 5-6 months, he articulated some bilabials, i. e. nasals [m], plosives [p], [b], and some palatals, i. e. nasals [ɲ], plosives [c], [ɟ]. At 1 year and 9 months, he articulated some velar plosives [k], at 2 years and 1 month, some alveolo-palatals, i. e. affricates [tɕ], fricatives [ɕ], at 2 years and 7 months, some dental or alveolar nasals [n], plosives [t], and some velar nasals [ŋ], plosives [g]. From 1 year and 6 months on, he articulated some glottal plosives [ʔ], but at 2 years and 7 months he articulated them less frequently.

Case B: a female infant with cleft soft palate (Fig. 5-2). She began to use meaningful words from 1 year and 3 months. Just after palatoplasty, at 1 year and 9 months, she articulated some palatal plosives[c], and some glottal plosives [ʔ]. At 2 years she articulated some velar plosives [k], at 2 years and 3 months, some bilabial plosives [p], at 2 years and 7 months, some bilabial nasals [m], plosives [b], some dental or alveolar fricatives [s], some alveolo-palatal affricates [tɕ], fricatives [ɕ], some palatal nasals [ɲ], plosives [ɟ], and some velar nasals [ŋ], plosives [g]. From 1 year and 9 months on, she articulated some glottal plosives [ʔ], but at 2 years and 7 months, she did not articulate them any more.

Case C: a male infant with cleft lip and palate (Fig. 5-3). He began to use meaningful words from 1 year and 1 month. 1 month before palatoplasty, at 1 year and 1 month, he articulated many palatal nasals [ɲ]. At 1 year and 4 months, he articulated some palatal plosives [ɟ], at 1 year and 5 months, some bilabial nasals [m], plosives [p], and some palatal plosives [c], at 2 years, some bilabial plosives [b], some alveolo-palatal affricates [tɕ], and some velar plosives [g], at 2 years and 6 months, some dental or alveolar plosives [t], and some velar nasals [ŋ]. From 1 year and 1 month on, he articulated some glottal plosives [ʔ], but after 2 years and 2 months, he articulated them less frequently.

Following was observed in case A, B, and C. Zero or several months after palatoplasty, from about 1 year and 6 months, they began to develop their phonemicization processes, almost at the same age as the normal infant did. At

first, they articulated bilabials and palatals. Next, they articulated velars and alveolo-palatals. At last they articulated dentals or alveolars. The developmental processes of meaningful speech sound articulation in infants with cleft palate were almost the same as that in the normal infant. As for the developmental processes of articulation of meaningful speech sounds we did not find any difference between case A, B, and case C.

At the same age or several months before the age of articulation of meaningful speech sounds, they articulated these speech sounds as meaningless. The time intervals between their ages of articulation of meaningless speech sounds and their ages of articulation of meaningful speech sounds were shorter than that of the normal infant.

At 2 years and 5-7 months, they articulated fewer kinds of speech sounds than those of the normal infant.

Case D : a female infant with cleft lip and palate (Fig. 5-4). She began to use meaningful words from 1 year and 1 month. 5 months before palatoplasty, at 1 year and 1 month, she articulated some bilabial nasals [m], and some glottal plosives [ʔ]. At 1 year and 5 months, she articulated some palatal nasals [ɲ], and many velar plosives [k], at 2 years and 1 month, some velar nasals [ŋ], and at 2 years and 5 months, some palatal plosives [ɟ]. At 2 years and 5 months, she articulated many glottal plosives [ʔ], but articulated only a few bilabial plosives [p], [b], dentals or alveolars [n], [t], [d], alveolo-palatals [tɕ], [dʑ], and palatal plosives [c]. She seemed to have incompetence in velopharyngeal function.

IV. Summary

We described the developmental processes of articulation of meaningless and meaningful speech sounds in 1 normal female infant, in 1 male and 1 female infant with cleft soft palate, and in 1 male and 1 female infant with cleft lip and palate. We described nasals, plosives, fricatives, and affricates.

1. From the beginning of her repetitive babbling period, i. e. from 5 months, the normal female infant articulated meaningless speech sounds actively. At first, she articulated bilabial nasals [m], and plosives [p], [b].

Next, she began to use her tongue to articulate nasals, plosives, and affricates. At first, the articulatory movement of her tongue was not differentiated. She moved her tongue as a whole. The middle part of her tongue touched at hard palate and alveolar, and produced palatal nasals [ɲ], plosives [c], [ɟ], and alveolo-palatal affricates [tɕ], [dʑ]. Then, after 1 year she differentiated her tongue movement at the back part, and articulated velar nasals [ŋ], plosives [k], [g]. At last, after 1 year and 6 months, she differentiated her tongue movement at the front part, and articulated dental or alveolar nasals [n], plosives [t], [d].

2. The infants with cleft soft palate and the infants with cleft lip and palate began to develop their articulation of meaningless speech sounds after palatoplasty. The processes of their articulation development were almost the same as that of the normal infant, described above. But most of them could not articulate dentals or alveolars by 2 years and 5-7 months. We did not find any difference between the infants with cleft soft palate and the infants with cleft lip and palate. The female infant with cleft lip and palate was the exception. She seemed to have incompetence in velopharyngeal function.

3. The normal infant began to use meaningful words from about 1 year. The number of her meaningful speech sounds increased from 1 year and 6 months. The infants with cleft soft palate and the infants with cleft lip and palate, except the female infant, showed almost the same developmental processes as that of the normal infant. But the number of their meaningful speech sounds , at 2 years and 5-7 months, were smaller than that by the normal infant.

4. The normal infant began to develop her phonemicization process from 1 year and 6 months. The developmental process of her tongue articulatory movement of meaningful speech sounds was the same as that of meaningless speech sounds. Almost 1 year after the age of articulation of meaningless bilabials, palatals, alveolo-palatals, she articulated meaningful bilabials, palatals, and alveolo-palatals. Almost 6 months after the age of articulation of meaningless velars, dentals or alveolars, she articulated meaningful velars, dentals or alveolars.

5. The infants with cleft soft palate and the infants with cleft lip and palate, except the female infant, began to develop their phonemicization processes, just after or several months after palatoplasty, i. e. from about 1 year and 6 months, almost at the same age as the normal infant did. And their developmental plocesses of meaningful speech sounds were almost the same as that in the normal infant. We did not find any difference between the developmental process of meaningful speech sounds in the infants with cleft soft palate and that in the infants with cleft lip and palate, except the female infant.

At the same age or several months before the age of articulation of meaningful speech sounds, they articulated these speech as meaningless. The time intervals beween their ages of articulation of meaningless speech sounds and their ages of articulation of meaningful speech sounds were shorter than that of the normal infant.

At about 2 years and 6 months, they articulated fewer kinds of speech sounds than the normal infant.

REFERENCES

1. Hirano, N., Nakazima, S., Kawano, M., Mitamura, K., Kuniyoshi, K., Inoue, M. 1989 The development of articulation in a normal infant — Compared with the development of articulation in infants with cleft palate —. *The Japan Journal of Logopedics and Phoniatrics,* Vol. **30**.
2. Kajino, H., Nakazima, S., Kawano, M., Hagio, F., Yamada, M., Isshiki, N., Ikeda, Y. 1982

Physical, mental and language development of an infant girl with cleft lip and palate. *The Annals of Kurashiki Central Hospital,* Vol. **51**, 33-43.

3. Kugo, S., Kawano, M., Hagio, F., Isshiki, N., Nakazima, S., Kajino, H., Ikeda, Y. 1982 A male infant with cleft lip and palate: A case report on physical, mental and language development and guidance. *The Annals of Kurashiki Central Hospital,* Vol. **51**, 9-23.
4. Kuniyoshi, K., Inoue, M., Hirano, N., Nakazima, S., Kawano, M., Isshiki, N. 1989 The development of articulation in infants with cleft palate. *The Japan Journal of Logopedics and Phoniatrics,* Vol. **30**.
5. Nakazima, S., 1962 A comparative study of the speech developments of Japanese and American English in childhood (1) — A comparison of the developments of voices at prelinguistic period —. *Studia Phonologica,* **II**, 27-46.
6. Nakazima, S. 1966 A comparative study of the speech developments of Japanese and American English in childhood (2) — The acquisition of speech —. *Studia Phonologica,* **IV**, 38-55.
7. Nakazima, S. 1970 A comparative study of the speech developments of Japanese and American English in childhood (Part Three) — The reorganization process of babbling articulation mechanisms —. *Studia Phonologica,* **V**, 20-35.
8. Nakazima, S. 1972 A comparative study of the speech development of Japanese and American children (Part Four) — The beginning of the phonemicization process —. *Studia Phonologica,* **VI**, 1-37.
9. Nakazima, S. 1973 A comparative study of the speech development of Japanese and American children (Part Five) — Preparation for the syntacticization process —. *Studia Phonologica,* **VII**, 1-11.
10. Nakazima, S. 1974 A comparative study of the speech development of Japanese and American children (Part Six) — Preparation for the developmental interrelation of the phonemiczation, the symbolization, and the syntacticization processes —. *Studia Phonologica,* **VIII**, 1-22.
11. Nakazima, S. 1975 Phonemicization and symbolization in language development. In E. H. Lenneberg & E. Lenneberg (Eds.), *Foundations of language development,* Vol. **1**. Academic Press, 181-187.
12. Nakazima, S., Kuniyoshi, K., Kawano, M. 1986 Development of articulation in infants with cleft palate. *Proceedings of the XXth Congress of the International Association of Logopedics and Phoniatrics,* 238-239.