A Comparison of Articulation Abilities and Velopharyngeal Competency Between Danish and Iowa Children with Cleft Palate

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The purpose of this study was to compare the articulation abilities and velopharyngeal competency of a sample of 108 cleft palate subjects from Denmark and 108 cleft palate subjects from Iowa. The Danish sample was selected for study because identification information for all children born with clefts in the western section of Denmark was available. In addition, the influence of surgeon variability was controlled since one surgeon had performed all surgical procedures. Although the Iowa group was less controlled, as is described later, it was felt that similarities and differences in treatment might provide additional information pertaining to speech results.

SUBJECT SELECTION. The records of all patients born in the western section of Denmark in 1963 and 1964 with a cleft of the lip and palate or a cleft of the palate were reviewed. Patients who were deceased, no longer living in the area, or who exhibited multiple congenital anomalies so severe that they could not be tested, i.e., severe brain damage, were excluded from the study. The available sample consisted of 123 patients of whom 108 were examined during the year of study. The fifteen patients who were not included failed to keep appointments with the examiner.

The Iowa sample was obtained from subjects who have participated in the Longitudinal Research Project, NIH DE-00853 (*2*). If an articulation test was recorded for a subject between the ages of 69 and 96 months, the subject was included; however, if a subject had more than one articulation test, the test closest to the mean age of the Danish group was used. The first 108 subjects who met the criteria were selected for study. Birthdates for the Iowa subjects ranged over an eleven year period, from 1953 to 1963.

From the records available at University Hospitals, Iowa City, Iowa and Statens Instituto for Talelidende, Aarhus, Denmark, a description of the type of cleft, sex, and age at time of surgeries was obtained. Table 1

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TABLE 1. Comparison of the Danish and Iowa Groups when cleft type is considered.

	male				*female*				*total*			
	Iowa		*Danish*		*Iowa*		*Danish*		*Iowa*		*Danish*	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
unilateral	23	21.3	33	30.6	23	21.3	14	13.0	46	42.6	47	43.5
bilateral	24	22.2	21	19.4	5	4.6	9	8.3	29	26.8	30	27.8
palate only	12	11.1	10	9.3	21	19.4	21	19.4	33	30.6	31	28.7
total	59	54.6	64	59.3	49	45.3	44	40.7	108	100	108	100

illustrates that in no major category (type of cleft) was there more than a 2% difference between the two groups. Although the total number of unilateral cleft lip and palate subjects was approximately the same, more Danish males exhibited this type of cleft (9%), and more Iowa females exhibited this type of cleft (8%). Sex ratio between the two groups was also similar (4.7% difference) with the basic difference in the unilateral cleft lip and palate group. Both samples were comparable to samples previously reported by Fogh-Andersen (*1*) and Wells (*9*) and approached the theoretical distribution for general cleft type of one-third cleft palate and two-thirds cleft lip and palate. The mean age at test date for both samples was 84 months, with a range of 69 to 96 months.

SURGERY. When age of lip repair was considered, the mean age of the Iowa group (N = 75) was 3.5 months and the mean age of the Danish group (N = 77) was 2.4 months. For those subjects requiring a second stage lip procedure, the mean age for the Iowa group (N = 16) was 5.7 months and the mean age for the Danish group (N = 30) was 4.4 months. In the Iowa group several different surgical procedures were used with 45% of the bilateral cleft lip subjects closed in a one-stage procedure, whereas in Denmark a Tennison procedure with vomerine flap was performed in unilateral cleft lip and palate cases and a two-stage Blair-Brown procedure was done on bilateral subjects.

For the Danish subjects the palatoplasty was a V-Y Wardill surgical procedure, whereas with this particular Iowa group, 90.7% of the subjects had the Von Langenbeck procedure (13.8% had a two-stage procedure, which included the vomerine flap). The mean age at palatoplasty for the Iowa group (N = 106) was 37.2 months and for the Danish group (N = 108) 24.6 months.

OBTURATION. None of the Danish subjects were obturated at the time of observation, whereas 8.3% of the Iowa subjects (N = 9) were obturated. In two of these subjects, obturation was elected over palatal surgery. In the other seven subjects (6.5%), the obturator was used either after partial breakdown of the palatoplasty or as a secondary palatal management procedure.

SECONDARY PALATAL MANAGEMENT. In the Danish group five subjects (4.6%) had secondary palatal management including one pharyngeal flap. In the Iowa group eleven subjects (10.2%) had a fistula repair while 14 (13%) had a pharyngeal flap.

In the Danish group, subjects were observed for the presence of an oral-nasal fistula. Oral-nasal fistulae were observed 47% of the time; however, comparison of articulation ratings and velopharyngeal competency did not demonstrate a significant difference between subjects with fistulae and subjects without. One explanation of this finding is that palatal closure was obtained more often in the fistula group as determined by lateral X-rays. In the Iowa group no specific data was available for the sample studied; however, it is our policy to generally close fistulae and it is doubtful, therefore, that more than 10% additional subjects would exhibit this condition.

SPEECH REMEDIATION. Review of the records at Statens Institut for Talelidende indicated that 45% of the Danish subjects had received speech remediation. The beginning age of remediation, frequency and number of sessions, clinician and methods, varied. For the Iowa group no specific data was available concerning remediation. It is estimated that approximately half of the subjects received one year of remediation in the public schools. Because of the lack of information concerning speech remediation, this variable was not evaluated in this report. Secondly, it appears that the effects of speech remediation are dependent, at least in part, on the adequacy of the velopharyngeal mechanism. Unless both variables are controlled it is most difficult to determine the influence of speech remediation on group data.

Examination Procedure

Observations and/or recordings were made for each subject on conversational speech, articulation tests, manometer ratios, assessment of velopharyngeal closure, evaluation of the oral mechanism and lateral X-rays on phonation of | s | or | u | (*5*, *6*). The assessment of velopharyngeal closure was made on the basis of a composite diagnostic evaluation—taking into consideration a subject's conversational speech, word articulation tests, manometer ratios, and oral examination. From the obtained information, the examiner rated each subject as having velopharyngeal competence, marginal competence, or velopharyngeal incompetence (*4*, *6*).

Articulation skills of subjects were evaluated in their native language by articulation tests described by Van Demark and Tharp (*8*) and Van Demark, Jørgensen, and Van Demark (*7*). In the latter study, a 99 item articulation test in Danish was developed, which included all items in the Danish Pressure Articulation test and common Danish blends. The test used for Iowa subjects consisted of 105 items and included items found in the Iowa Pressure Articulation Test, the Templin-Darley Screening Test of Articulation and phonemes in the initial, medial and final position.

From these tests, five different articulation scores were determined for both groups of subjects.

In the development of the Danish articulation test, the author attempted to construct a protocol similar to the Iowa test so that the two tests would be comparable. The articulation tests were scored (reliability of the examiners has been determined in previous papers) and prepared for computation according to the program described by Van Demark and Tharp (8).

Results

VELOPHARYNGEAL ASSESSMENT. As rated, 52 (48%) of the Danish subjects achieved velopharyngeal competence, 44 (41%) had a marginal mechanism, and 12 (11%) exhibited velopharyngeal incompetence. In the Iowa group 82 (76%) were rated as competent, 11 (10%) as marginal, and 15 (14%) incompetent. Although it appears that the Iowa group achieved a higher degree of velopharyngeal competency, when subjects with pharyngeal flaps or obturators were not included, 51 subjects in each group were rated as having a competent mechanism. One might speculate that more of the Iowa subjects exhibited a grossly incompetent mechanism since 22% were managed with a secondary procedure. It is also plausible that some of the Iowa subjects who had secondary management could have fallen within the marginal group proceeding secondary management.

When subjects were rated on other attributes, the results were highly similar and therefore, the data were not submitted to statistical tests. For example, Figure 1-A demonstrates that when subjects were rated on severity of nasality, using a seven-point equal appearing intervals scale, the Iowa group exhibited slightly less severe ratings. This would be expected since a larger percentage of the Iowa group had secondary management. In articulation ratings (Figure 1-B), the two groups appeared even more similar. When positive manometer ratios with bleed were compared (Figure 1-C), the Iowa group had a higher percentage with ratios of 1.00, but this also would be expected if secondary management procedures were successful. When lateral X-rays were evaluated, using a five-point scale of degree of velopharyngeal competence (Figure 1-D), the two groups were again similar. Thus on these four measures of velopharyngeal competency the two groups were strikingly similar even though the type of palatal surgery and age of surgery were different.

ARTICULATION TESTS. Comparisons of articulation tests for Danish and Iowa subjects indicate that they are highly similar in articulation skills, yet subjects are significantly retarded in articulation skills when compared to their normal peers (4, 7). The results of five scores derived from the articulation tests are presented in Table 2. Although the Iowa group performed better on all tests, the greatest difference was less than 9% and none of the differences were significant at the .01 level of confidence.

TYPES OF ERRORS. When between group comparisons were made for the various types of errors, presented in Table 3, the Danish group exhibited

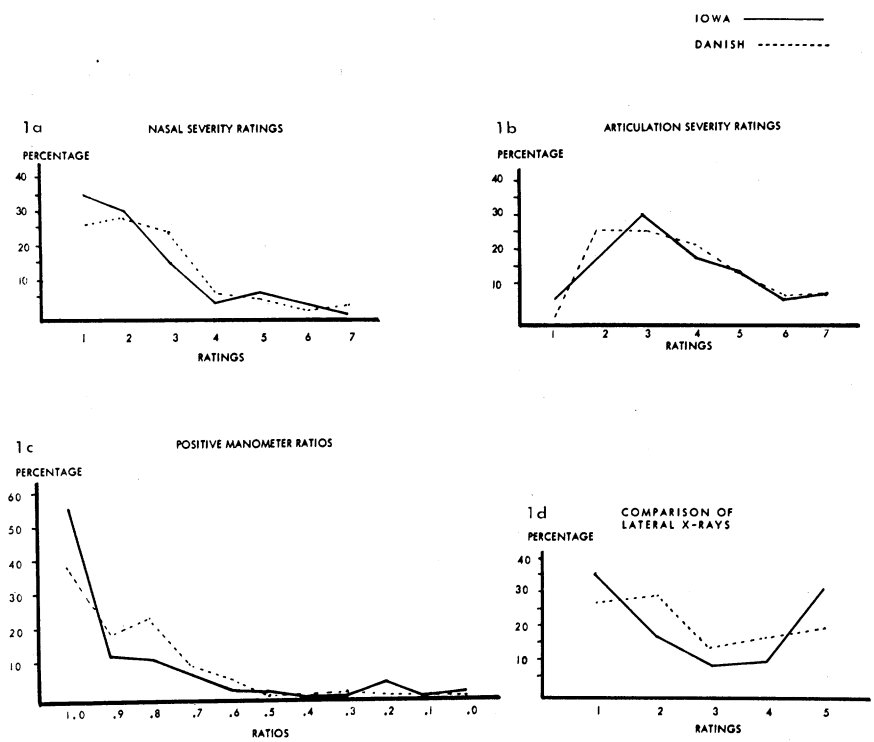

FIGURE 1. Comparison of Danish and Iowa subjects on nasal severity ratings, articulation severity ratings, positive manometer ratios and degree of velopharyngeal closure on lateral X-rays.

significantly more oral and nasal distortions and more omissions, while the Iowa group exhibited more substitutions.

COMPARISONS AS CLASSIFIED BY DEGREE OF VELOPHARYNGEAL COMPETENCE. When the Danish groups were compared on five articulation test scores, the closure group performed significantly better (.01) on all tests than the marginal and no closure groups. The marginal group performed significantly better (.01) than the no closure group. When the Iowa groups were compared on the five articulation test scores, the closure and marginal group performed significantly better than the no closure

TABLE 2. Results of five scores from Danish and Iowa articulation tests (in each group, N = 108). None of the *t*s were significant at the .01 level of confidence (2.58).

articulation test	*Danish %*	*Iowa %*	*t*
43–44 item pressure	44.52	46.67	.33
51 element, excluding pressure	43.55	51.52	.036
99–105 item test	49.22	54.24	1.77
149–152 element test	60.31	63.92	.25
43 item articulation test	38.13	46.67	2.46

TABLE 3. Comparison of types of production for Iowa and Danish subjects (in each group, N = 108)

type of production	*Iowa*	*Danish*	*t-Test**
correct	64.79	59.82	.56
mild oral distortion	4.05	3.10	1.86
moderate oral distortion	2.80	6.98	5.41**
severe oral distortion	.82	2.38	6.02**
any degree oral distortion	9.19	12.47	2.09
mild nasal distortion	1.32	4.48	6.57**
moderate nasal distortion	.83	5.67	8.17**
severe nasal distortion	.23	2.73	8.84**
any degree nasal distortion	5.67	12.89	5.00**
substitution	7.29	5.57	1.88
substitution—nasal	.42	.87	4.58**
substitution—glottal	3.32	1.01	6.80**
substitution—pharyngeal	1.30	.27	7.92**
omissions	4.78	7.88	3.31**

* t = .01 2.58.
** t = .001 3.29.

group (.01). There was no significant difference between the marginal and closure groups; however, on all tests the closure group achieved the highest scores.

Contrary to some writings in the literature, the results of this study indicate that there may not be important differences between these two surgical procedures as performed with these two subject groups (that is the Von Langenbeck at age three and the V-Y Wardill at age two). It should be pointed out that since these subjects were not matched and since more than one variable was involved, it is impossible to determine if type of surgery, age at surgery or surgical experience are crucial variables. The study does demonstrate that with either procedure the percent of subjects who achieve velopharyngeal closure after primary surgery is not particularly high.

Discussion

The two groups of subjects in this study were highly similar in both velopharyngeal competency measures and articulation scores. Although the percent of various cleft types was essentially the same for the two groups, the groups differed in management procedures. In the Danish group a V-Y Wardill palatoplasty done by one surgeon was performed at 24 months of age. In the Iowa group, the majority of the subjects had a Von Lagenbeck palatoplasty, done on the average some 12 months later. Since the University of Iowa is a training institute there were many different surgeons.

Comparison of articulation scores indicates that the two groups were both retarded in articulation skills (*4*, *7*), yet highly similar to each other.

On none of the five articulation tests administered was there a significant difference between the two groups. When subjects were subclassified into categories of velopharyngeal closure, marginal velopharyngeal closure, and inadequate velopharyngeal closure, and closure groups were compared, no statistically significant difference occurred on the percent of correct articulation between any of the three closure groups. However, as was demonstrated in a previous paper (*5*), articulation scores tend to dichotomize between subjects who achieve closure and those who do not.

When types of articulation errors were considered, the Danish group exhibited more oral and nasal distortions and more omissions than did the Iowa group, while the latter group exhibited more substitutions. Two factors may contribute to this finding in that more Danish subjects exhibited oral-nasal fistulae, thus perhaps accounting for the increased number of nasal distortions, and that Danish children apparently complete articulatory maturation at a later age (*7*). When closure groups were compared, i.e., Danish subjects with closure vs. Iowa subjects with closure, the trend was still evident that Danish subjects tended to exhibit more distortions (both oral and nasal) while Iowa subjects exhibited more substitutions. If velopharyngeal closure was achieved, oral distortions were most common; however, as velopharyngeal closure decreased, more nasal distortions occurred. Substitutions (nasal, glottal, and pharyngeal) also became more frequent. This trend was evident in both Danish and Iowa subjects and indicates that as velopharyngeal competency decreases, the type of error which occurs will most likely change from an oral distortion to a nasal distortion and/or atypical substitution.

Summary

One hundred and eight subjects from Denmark and from Iowa were compared on articulation abilities and velopharyngeal competency. The type of clefts and sex ratios for the two groups were highly similar. Although surgical procedures differed, evaluation of the two groups with primary surgery indicated the same percentage of velopharyngeal competency. When articulation scores were compared, the two groups were both retarded in articulation skills, yet highly similar to each other.

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