Surgical and Speech Results Following Palatopharyngoplasty Operations in Denmark 1959–1977

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This study analysed surgical results from 600 palatopharyngoplasties (PPP), performed from 1959–77 by Dr. Poul Fogh-Andersen, Copenhagen, and the speech results in 140 of these cases. There were 205 cases of cleft lip and palate (CLP), 133 of cleft palate (CP), 104 of submucous cleft palate (SMCP), 138 of velopharyngeal insufficiency (VPI), and 20 cases of velar paresis. At surgery 62% were younger than ten years, and 5% were older than 30 years.

Speech results were evaluated from pre-and postoperative tape recordings. Normal nasal resonance was obtained in 74%, improvement to mild symptoms in 24%. Submucous cleft palate cases had the highest rate of normalization, VPI cases the lowest. The cases with severest hypernasality had the lowest normalization rate.

Age and operative procedure were of minor importance in relation to speech results, but surgical complications were fewer in subjects younger than ten years. Postoperative speech therapy was given to 38%, predominantly to subjects with compensatory voice and articulation problems.

In Copenhagen, as in most other cleft palate centers, satisfactory speech results are found in about 80% of the cleft palate cases (CLP and CP) as a result of primary palatoplasty. Another 15% achieve acceptable speech with the aid of speech therapy. The remaining 5% require secondary management because of insufficient velopharyngeal closure. A considerable number of cases with submucous cleft palate (SMCP) and other palatal anomalies (VPI) are treated with pharyngeal flap as a primary surgical procedure. Since the early fifties (Fogh-Andersen, 1953) Dr. P. Fogh-Andersen has performed the palatopharyngoplasties (PPP) referred from the two Danish Institutes for Speech Disorders, at Diakonissestiftelsen's Hospital in Copenhagen—more than 600 cases.

The present retrospective study is an analysis of the results of this large number of PPPs.

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Sample

The sample consisted of 600 cases referred for PPP surgery by the two Institutes for Speech Disorders in the period 1959–1977. All the cases were operated on by the same surgeon. Sixty-two per cent of the patients were younger than ten years at surgery, five per cent were older than thirty years. The sex ratio was 1:1 with no significant age difference (Figure 1). Twenty-two per cent of the patients (133) had cleft palate (CP), thirty-four per cent (205) had cleft lip and palate (CLP), with left clefting in fifteen per cent, right clefting in nine per cent, and ten per cent bilateral. Table 1 presents the type of problem and the type of surgical procedure used.

Cleft palate was often combined with other anomalies and syndromes. Ninety-two different types of congenital anomalies were found. The distribution of the fifteen most frequent of these is shown in Table 2.

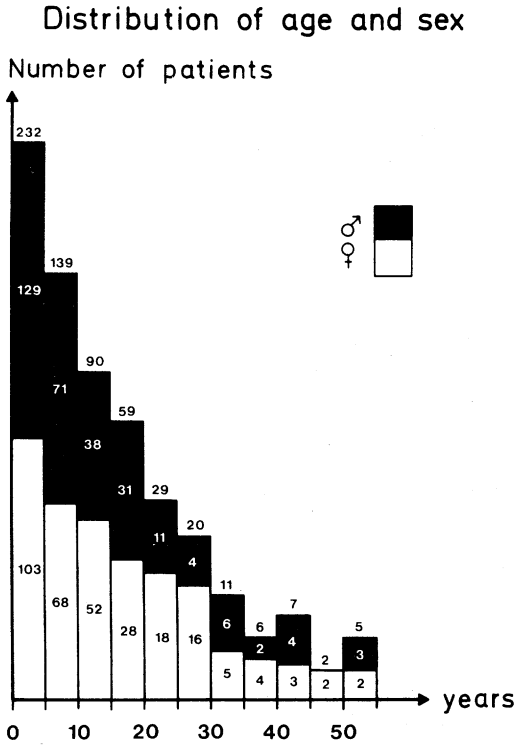

FIGURE 1. Distribution of age and sex in 600 patients treated with palatopharyngoplasty 1959–77.

TABLE 1. Diagnosis and Type of Surgery

	Superiorly based	*Inferiorly based*	*TOTALS*
VPI	14	124	138
SMCP	90	14	104
CP and CLP	108	230	338
Paresis of the velum, unilat.	0	9	9
Paresis of the velum, bilat.	2	9	11
TOTALS	214	386	600

TABLE 2. The most frequent anomalies and syndromes in cleft palate patients with velopharyngeal insufficiency, having ppp-operation performed 1953–1976

Mental retardation	27
Pierre Robin syndrome	13
Perinatal encephalopathia	11
Congenital hearing loss	8
Labial fistula	8
Inguinal hernia	7
Epilepsy	6
Mandibular hypoplasia	6
Convergent strabismus	5
Ocular amaurosis	4
Irital coloboma	4
Auricular deformity	4
Alatal auricular deformity	4
Cardial septal defects	4
Hypospadia	4

Most of the patients with SMCP had PPP based superiorly (Sanvenero-Roselli, 1934), while the other patients usually had inferiorly based flaps (a.m. Schönborn-Rosenthal). The reason for this choice of methods is found in early Danish and Swedish studies. A Danish study of 64 palatopharyngoplasties showed better speech results with the inferiorly based flap technique (Liisberg, et al. 1966). In a Swedish study serious postoperative complications were reported following surgery with the superiorly based flap technique. In cases with large velopharyngeal insufficiency, however, superiorly based flaps are preferable, because their size is not as limited as with the inferiorly based flaps (Nylén and Wåhlin, 1966). During the period 1962–1975 the use of inferiorly based flaps was increasing, while that of the superiorly

based flaps was fairly constant. In recent years the frequency of superiorly based flaps has increased.

From the 600 operated cases 140 cases were selected for speech analysis to be representative as to diagnoses, and with approximately equal numbers from the three age groups: 0–7, 8–15, and older than 15 years at operation. Mentally retarded cases were excluded.

Method

Tape recordings of a set text of connected speech from immediately before the operation, six weeks after, and an average of five years (one to nine years) after, were assessed by the same three speech pathologists, who had worked full time for more than ten years in the cleft palate department. The inter judge reliability was accordingly very high but was not measured.

The following parameters of speech were assessed: Hypernasality, nasal escape, and glottal and pharyngeal realizations, graded in a four point scale, normal to severe. Dysphonia (voice disorders) and hyponasality were rated present or not. Information from case files was registered as to possible complicating factors, and to speech therapy given after PPP.

Results

Morbidity

In the postoperative period total or partial rupture of the PPP occurred in 15 cases (2.5%), and 7 patients developed a fistula in the flap (Table 3). Bleeding complications were experienced by 48 patients, but hemostasis was achieved by gentle oral pressure of the flap.

Complicating acute otitis was found in 9 cases, and 9 patients with no previous history of otitis developed occlusion of the Eustachian tube and effusion in the middle ear. As one third of all the patients had previously had remittant otitis, there is no significant actual risk of otologic complications during the postoperative period after PPP.

During the eighteen years' experience with PPP surgery, one postoperative death occurred. This 39 year old man with VPI died three months after the operation from hypoxemia of the brain after postoperative heart arrest in the recovery unit.

In the literature (Leanderson, 1974, Nylén and Wåhlin, 1966, Skoog, 1965) it is reported that age at the time of operation and previous surgery in the pharynx (e.g. palatoplasty, previous pharyngeal flap, adenoid-and tonsilectomy) may complicate the postoperative course. In the present material total rupture of the PPP took place only in patients older than ten years of age, but with regard to bleeding complications, fistulation, and partial rupture, age had no significance. Total or partial rupture occurred in 11 cases, in which adenoidectomy had been performed shortly before the PPP. Among 87 patients with previous speech bulb treatment total rupture of the flap was seen more often than in other patients (4% versus 0.5%).

Secondary reconstructive surgery was necessary in 48 cases; 26 patients received a new flap, and 11 cases a supplementary flap. Out of the 48 reconstructions, 15 were primarily uncomplicated but atrophied later to such an extent that a new or supplementary flap was necessary to restore acceptable speech quality (Table 4). Most of these patients were cleft palate cases. In one case the patient preferred speech bulb treatment, and subsequently the pharyngeal flap was removed.

Speech Results

The 140 cases consisted of 41 with CLP, 32 with CP, 26 with SMCP, and 41 with

TABLE 3. Postoperative complications

	None	*Bleeding*	*Partial rupture*	*Total rupture*	*Fistulation*
sup. based	201 (93.5%)	3 (1.5%)	1 (0.5%)	3 (1.5%)	6 (3.0%)
inf. based	329 (85.7%)	45 (13.7%)	7 (2.1%)	4 (1.2%)	1 (0.3%)
Total	530 (90.0%)	48 (9.1%)	8 (1.5%)	7 (1.3%)	7 (1.3%)

TABLE 4. Cases requiring secondary reconstructive surgery.

	None	*New ppp based sup.*	*New ppp based inf.*	*Too wide ppp*	*Too narrow ppp*	*Closure of fist.*	*Transc. of ppp*
Based sup. (n = 214)	183 (85.5%)	3	15	0	6	7	0
Based inf. (n = 386)	369 (95.8%)	1	7	2	5	1	1
TOTALS (n = 600)	552 (92.0%)	4	22	2	11	8	1

VPI. This latter group included 13 cases with uncertain diagnosis of velar paralysis.

Hypernasality in connected spech (Table 5 and Figure 2a) was the parameter of speech common to all the 140 cases preoperatively. (45 with severe, 82 with moderate, 13 with mild hypernasality). Six weeks after PPP 42 patients had hypernasal speech (none with severe symptoms, eight with moderate, and 34 with mild symptoms of hypernasality). At the latest examination, averaging five years postoperatively, 104 patients (74%) had normal nasal resonance (NNR), 36 cases (26%) had hypernasal speech (two with moderate, the rest with mild symptoms). All except two improved in this parameter of speech.

In some cases nasal resonance changed during the observation period. Immediate normalization appeared in 98 cases (70%) six weeks after PPP, and a further 23 cases (16%) showed progressive improvement and obtained NNR during further observation (average five years). Hypernasal speech returned in 17 cases (12%) to a mild degree five years after PPP. Two of them had had secondary flap surgery performed and did not wish and further treatment. The 45 patients with severe hypernasality preoperatively showed the lowest rate of normalization (62%) five years postoperatively (Table 5). The normalization rate of moderate and mild hypernasality was 78% and 92% respectively. All cases but two improved.

Nasal escape on oral consonants (Figure 2b) was present in 126 cases (90%) preoperatively, and 99 cases (79%) were normalized. Six weeks after PPP 59 patients had audible nasal escape, and after five years this symptom remained in 27 patients. In spite of normalized resonance eight patients had persisting nasal escape.

TABLE 5. Normalization of severe preoperative hypernasality related to diagnoses

Type		*Severe hypernasality*	*Resonance normalized*
CLP	(41)	12	8
CP	(32)	11	6
SMCP	(26)	7	6
VPI	(41)	15	8
Total	140	45	28

Glottal and pharyngeal production of oral consonants (Figure 2c) was found in 31 cases (22%) preoperatively. Six weeks after PPP 7 cases were normalized spontaneously, and the remaining 24 cases had reduced severity. Five years later another three cases were normalized without speech therapy. There were 11 cases remained with glottal and pharyngeal production, giving a normalization rate of 65%. Ten of these had persisting glottal and pharyngeal production in spite of normalized resonance.

Dysphonia (voice disorders) (Figure 2d) was present in 66 cases preoperatively, in 51 cases six weeks after, and in 26 five years after PPP. The normalization rate was thus 61%.

Hyponasality (Figure 2e) is mainly an acquired symptom, due to postoperative edema in the velopharyngeal area, and was found in 55 cases (39%) six weeks after PPP. Ten CLP cases with preoperative mixed nasality, due to deviated nasal septum, were left out as dubious in the evaluation of postoperative hyponasality. Only 9 patients had persisting hyponasality five years after PPP: 8 of them had had one or

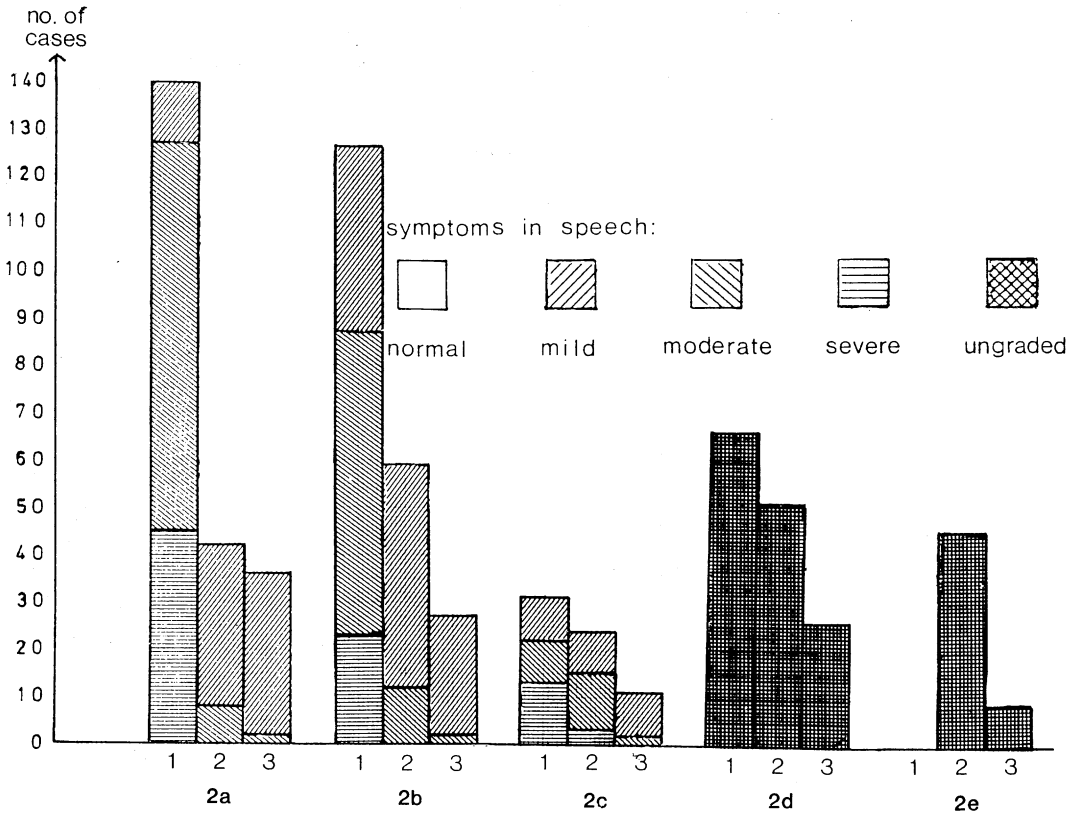

FIGURE 2. Speech symptoms in 140 cases before (1), 6 weeks (2) and 5 years (3) after PPP. 2a: Hypernasality in connected speech; 2b: Nasal ascape in oral consonants; 2c: Glottal and pharyngeal consonant realizations; 2d: Dysphonia; 2e: Postoperative hyponasality.

more surgical revisions of the ports with little effect on resonance. Allergological and fiberoptic examinations revealed allergic rhinitis in three cases, and granulous or adenoid tissue in the nasopharynx, obturating the ports, in six cases. The allergic rhinitis was treated by local antiallergic drugs and injections of allergenes. The granulous or adenoid tissue was cauterized with 20% solution of silvernitrate through the port openings, monitored by fiberoptic nasopharyngoscopy. In all cases the nasal blockage and hyponasality were reduced (Prytz, 1983).

Speech Results Related to Diagnosis

The overall rate of total normalization of speech with regard to hypernasality in connected speech, nasal escape, and glottal and pharyngeal productions in the four diagnostic groups five years after PPP was 65%. For the CLP, CP, and VPI groups each it was about 60%, and for the SMCP group 81%.

Improvement and normalization of nasal resonance is shown in Figure 3a. The normalization rate varies from 84% in the SMCP group to 67% in the VPI group. The two patients with moderate hypernasality were found in the CLP and CP groups. The rest had only mild hypernasality.

Nasal escape (Figure 3b) was fairly evenly distributed among the four diagnostic groups, slightly higher in the CLP and CP groups. The only two cases with persisting moderate symptoms five years after PPP, were found in the CLP and CP groups.

There were 31 patients (22%) with glottal and pharyngeal productions before surgery. Five years after PPP these symptoms

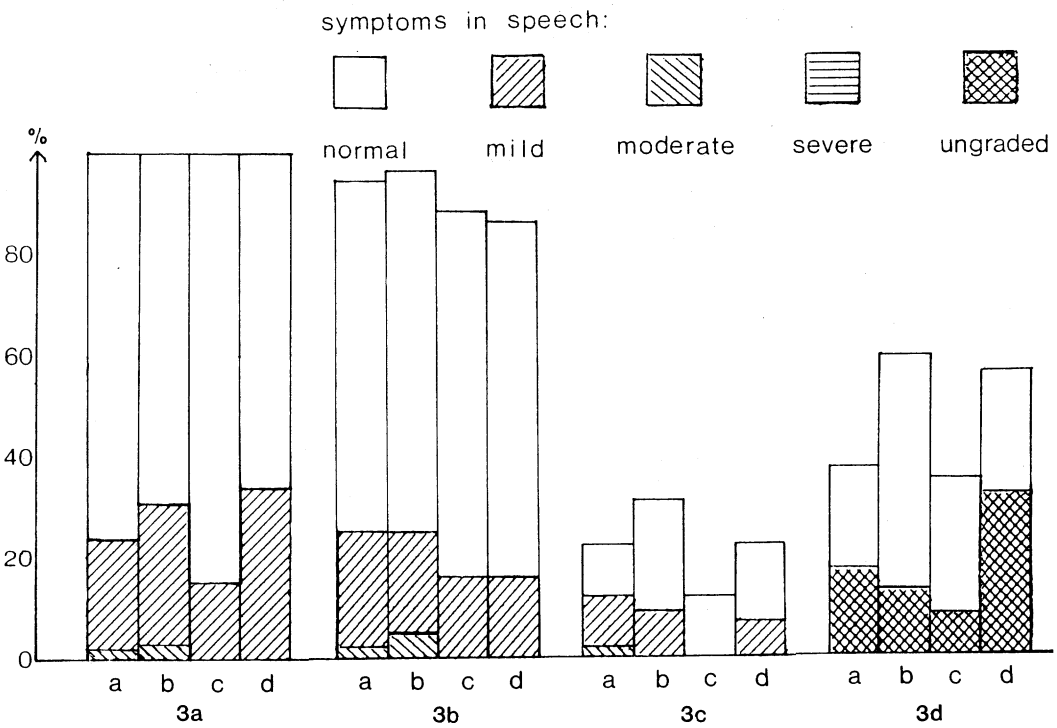

FIGURE 3. Speech symptoms in 140 cases 5 years after PPP, related to diagnoses: a: CLP, b: CP, c: SMCP, d: CPI. 3a: Hypernasality in connected speech; 3b: Nasal ascape in oral consonants; 3c: Glottal and pharyngeal consonant realizations; 3d: Dysphonia.

were totally eliminated in the SMCP group and reduced in the other groups (Figure 3c).

Dysphonia was present preoperatively in 66 cases (47%). More than half of the patients in the CP and VPI groups had this symptom. The VPI group still had the highest rate of persisting dysphonia (32%) five years after PPP (Figure 3d).

Speech Results Related to Age at PPP

The sample was divided into three age groups at PPP: A; younger than eight years (n = 43), B; between eight and fifteen years (n = 52), C; above fifteen years of age (n = 27). There was no significant difference between the age groups as to total normalization (Figure 4). The youngest group acquired the highest rate of NNR (Figure 5a), but the difference from the two older groups was not striking. As to nasal escape (Figure 5b) there was no statistical difference between the groups.

Glottal and pharyngeal articulation was found with the highest incidence in the youngest group before PPP surgery (Figure 5c). Only 9% remained five years after. In the oldest group the preoperative incidence, 18%, was reduced to 13% five years

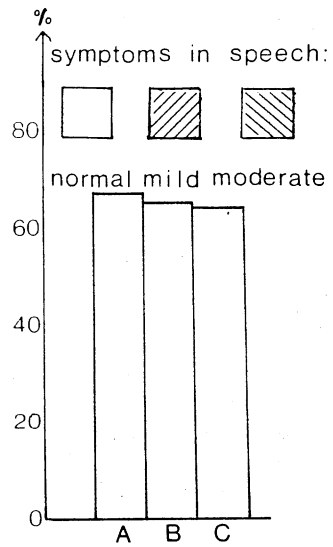

FIGURE 4. Total normalization of speech 5 years after PPP, related to age: A: 0–7 years, B: 8–15 years, C: above 15 years.

after. The two cases with persisting moderate symptoms were found in this group, the rest had only mild symptoms.

Dysphonia (Figure 5d) was found preoperatively in 60% of the youngest group with a steeper normalization rate compared to the other groups.

Five years after surgery nine cases had persisting hyponasality, only one of these patients was older than 15 years.

NNR Related to Operative Procedure

The superiorly and the inferiorly based PPP were distributed as shown in Table 6. The SMCP group showed the highest normalization rate, regardless of procedure. There was no significant difference in the speech results between the two operative procedures.

Of the 15 cases where secondary reconstructive surgery was required 8 acquired NNR, and 6 superiorly based flaps were replaced by inferior based flaps, with 3 of these obtaining NNR.

Speech Results Following Speech Therapy

After the operation 49 patients (35%) received speech therapy, 21 because of glottal and pharyngeal articulation. As a result, 57% (28 cases) were totally normalized.

Speech Results in Cases with Preoperative Speech Bulb Treatment

Before PPP surgery 27 patients had speech bulb treatment. Speech was totally normalized in 59% after surgery.

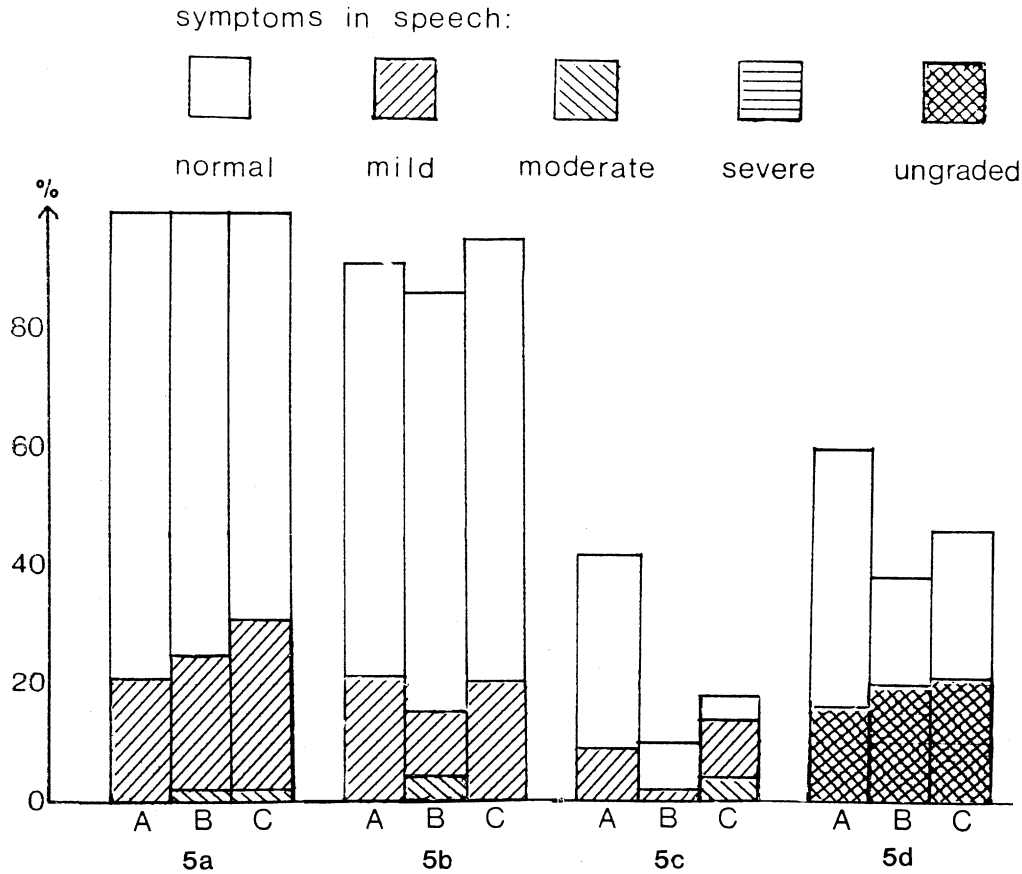

FIGURE 5. Speech symptoms in 140 cases 5 years after PPP, related to age: A: 0–7 years, B: 8–15 years, C: above 15 years. 5a: Hypernasality in connected speech; 5b: Nasal ascape in oral consonants; 5c: Glottal and pharyngeal consonant realizations; 5d: Dysphonia.

TABLE 6. Normal nasal resonance (nnr) related to operative procedure

Diagnoses		*Sup. based*	*nnr.*	*inf. based*	*nnr.*
CLP	(41)	12	9	29	22
CP	(32)	9	6	23	16
SMCP	(26)	22	19	4	4
VPI	(41)	3	2	38	26
Total	140	46	36 (78.2%)	94	68 (72.3%)

Accompanying Speech and Hearing Disorders

Accompanying preoperative speech and language disorders were present in 24 cases (eighteen language disorders, three speech disorders, one motor speech disorder, one stuttering). Impaired hearing was found in 23 cases. The average speech results were not affected by the accompanying speech and hearing disorders in this group.

Discussion

Bleeding after PPP surgery was formerly a feared complication and occurred rather frequently in the present material (48/600), but only in four cases blood transfusions were necessary. The only death that occurred was not due to bleeding but to heart arrest during recovery from anaesthesia. In a Swedish study (Nylén, Wåhlin, 1966) of 103 PPP operations postoperative bleeding occurred in 14 cases, of which one patient died, and four had to be tracheostomized.

In patients with CP and CLP postoperative complications are more frequent than in the other diagnostic groups (Nylén, Wåhlin, 1966, Skoog, 1964). This is perhaps due to the fact that all these patients have had a primary palatoplasty at two years of age. Five percent of these patients have had several operations in the palate, leaving the area for PPP with scarred, partly unelastic and badly vascularized tissue. In spite of this the speech results are the same for patients with VPI as for the CLP and CP groups. Surgery in the pharyngeal area previous to the PPP does not seem to influence the speech results either.

The advantage for the SMCP group as against the other diagnostic groups may be assumed to be:

1. No previous surgery causing scar tissue as mentioned above, and less insufficiency in velopharyngeal muscle-function than the CP and CLP groups.

2. A well-defined diagnosis for a rather homogenous group of patients, as against the complexity of the VPI group (Croft, Shprintzen, Rakoff, 1981) with various causes for velopharyngeal insufficiency or incompetence, including anatomical and physiological as well as neurological causes (congenital short velum, occult SMCP, slight bilateral paralysis, dyscoordination of velopharyngeal movement etc.).

As to hearing impairment or frequency of otitis media, no reliable difference is found between CP, CLP, and SMCP patients in the literature (Heller, 1979, Stool, 1971), and in the 600 cases of the present study no significant difference as to frequency of acute, serous or cronic otitis is found (SMCP 31%, CP and CLP 40%). Postoperatively acute otitis only occurred in very few cases. The slightly higher incidence in the CP and CLP groups may be explained by the fact that these patients were older at PPP in the early years of the study and already had acquired cronic otitis.

Concurrent with other studies (Lindholm, 1971, Liisberg, Paulsen, Fogh-Andersen 1969) this investigation shows that the type of operative procedure had no influence on the final speech results. However it should be noted that the SMCP group, which had the best speech results, almost invariably had a superiorly based PPP. Preoperative speech bulb treatment influenced the frequency of complications immediately after the operation but had no significant influence on the final speech results.

Even if all the secondary PPP operations (10%) were successful, the final speech results were inferior to the speech results for

the rest of the material. This may be explained partly by cicatricial changes and poor function of the pharyngeal musculature. In a few cases persisting speech habits were a predominant problem in spite of logopedic treatment. (Leanderson, 1974, Nylén, Wåhlin, 1966).

PPP had an immediate as well as a more gradual effect on the speech of the patients. NNR as an immediate effect of PPP was obtained by 74% of the patients, while the more habitual voice and articulation disorders were reduced gradually. The final speech results in this study are not directly comparable with those of other studies because of varying criteria for evaluation. Huffstadt et al. reports a normalization of rhinolalia in 51% (Huffstadt et al., 1970) which perhaps corresponds with the total normalization rate, 65%, in this study. No difference was found between the CLP and CP groups as to normalization rate in the postoperative observation period. This contrasts with the results of Riski (1979), in which the CLP group had a very small immediate normalization rate and a smaller final percentage of normalization than the CP group.

Five years postoperatively 34 patients still had mild hypernasality, but for various reasons they found their speech acceptable and so did not wish further treatment.

Logopedic treatment was necessary in 35%, mainly to eliminate old speech habits, but also to adjust the speech function to the new structural conditions in the pharynx. In a Swedish study (Lindholm, 1970) all cases had postoperative speech therapy. A reason for the low percentage of postoperative speech therapy needed in this study may be the centralized, continuous care of cases with velopharyngeal anomalies in Denmark.

According to the speech results, as seen in Figures 4 and 5abcd, there was only a slight advantage with operation before seven years of age. This is concordant with the findings of Albery et al., 1982. Yet in cases with compensatory articulation defects and dysphonia the rate of improvement postoperatively was greater in the two youngest groups.

The advantage of early operation seems to be more marked in other studies. Huffstadt et al., 1970, Riski, 1979). In this respect also, direct comparison is difficult, firstly because this study comprises submucous and VPI patients as well as cleft palate cases, secondly because the three age groups contain an equal number of patients, so that the older groups are comparatively better represented than in most other studies. From a surgical point of view, however, the results of this study show certain advantages in operation before ten years, so taken all in all there are fewer problems for the individual patient, if PPP is performed early in life. The severest cases of preoperative hypernasality occur most frequently in the VPI group, which generally in this study has the most serious speech symptoms—postoperatively as well as preoperatively. Among the SMCP patients 25% had severe preoperative hypernasality against 35% in the VPI group. The cases with preoperative mild hypernasality all developed NNR. In this investigation a direct correlation between the preoperative severity of hypernasality and the final speech result is apparent.

Conclusion

The results of the present study lead to the following tentative conclusions:

1. The overall prognoses for normalization of nasal resonance by PPP is 74%, and for improvement to mild symptoms a further 24%.
2. Speech results vary with diagnoses: SMCP cases have the highest rate of normalization, VPI the lowest.
3. Normalization rate for hypernasality diminishes with the degree of preoperative hypernasality.
4. Age is of minor importance for speech results, but surgical complications are fewer in patients less than ten years old.
5. The two operative procedures, used in this material render approximately the same surgical and speech results.
6. Speech therapy is necessary in cases with accompanying speech and voice disorders. The incidence of preoperative compensatory voice and speech symptoms is higher in the young patients. The prognosis seems to be better in this group.

The most important conclusion appears to be the awareness of the complexity of

the VPI group. These cases should be thoroughly diagnosed, and alternative treatment, logopedic or otherwise, should be tried before PPP is decided. (Ørsted, 1983). In the period covered by this study examination methods have been simple, but because of the large material, and the centralized system for patients with palatal anomalies, the conclusions drawn from this study may be considered as valid and useful for further prospective studies.

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