VIII. Evaluation and Habilitation
A comment by Kilner on his approach toward judging palate speech results is interesting:

In the past, surgeons were satisfied if they could exhibit completely closed palate defects and much ingenuity has been shown in developing ways and means of obtaining such results. Today the tongue depressor and torch should play no primary part in the examination of repaired palates. If the patient can speak clearly and naturally, if he can snort (Wardill) and if he can blow up a balloon or extend a "carnival blower," it is obvious that he possesses efficient naso-pharyngeal sphincteric control and no visual examination is needed to indicate whether the repair operation has been successful.

BZOCH

In 1977 Bzoch of the University of Florida wrote:

The evaluation of velopharyngeal adequacy or inadequacy following primary palatal surgery does not appear to be as complicated as many of our research colleagues in the field of speech pathology indicate. It can be undertaken between 12 and 18 months of age following primary closure as a routine. Palatal valving is adequate for speech when it can be demonstrated to support normal syllable speech production. Therefore, clinical tests focusing directly on speech behavior with observations of the frequency of normal or abnormal nasal emission occurrence while impounding the breath stream for simple speech utterances, such as the word puppy or paper, provide one important index of palatal adequacy and can be obtained even with very young children. The second important direct index is a count of nasal
resonance tone shift by the cul-de-sac resonance test, where the nares are alternately pinched and left open during the utterance of simple words. The shift in tone, if hypernasal resonance is present, can be picked up even in a noisy chairsde situation with a cooperative youngster.

MILLARD

Robert T. Millard, chief of speech and hearing at the Lancaster Cleft Palate Clinic, in 1977 discussed the cleft palate problem lucidly:

In a nutshell, the person with a cleft condition may have a problem of voice quality and/or articulation. One must establish the adequacy of velopharyngeal function. Inadequacy or incompetency of the velar mechanism promotes hypernasality. For most patients, hypernasality can be effectively reduced with surgery or a prosthesis—according to the dictates of the team.

Articulation disorders are subject to the age of the patient and to violation of the rigidity of phonetic classification. Consonant sounds are charted according to manner of production and placement of the articulators. That's it. A study of the patient's errors according to placement or manner of production determines the mode of therapy.

My credo is listen to speech, then look at the mechanism in action. The patient does or does not have adequate velopharyngeal valving. The patient does or does not have adequate placement for consonant sounds. The patient's manner of sound production (plosives, fricatives, etc.) is or is not acceptable.

Design your therapy to meet the needs of your diagnosis with or without the services of the plastic surgeon or prosthodontist. There is no special "cook book" treatment—just common sense derived from experience of the team.

BENSEN'S COOKBOOK

In 1977 in Plastic and Reconstructive Surgery Jack Bensen, speech pathologist at the University of Miami, presented a fairly accurate five-minute velopharyngeal competence testing checklist for the plastic surgeon without a cleft palate clinic.

A CHECK LIST FOR EVALUATING SPEECH

1. Running conversation
   ——— Normal
   ——— Deviant from normal
2. Counting to 20

<table>
<thead>
<tr>
<th>Voice quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>sounds normal</td>
</tr>
<tr>
<td>Voice quality</td>
</tr>
<tr>
<td>slightly nasal</td>
</tr>
<tr>
<td>Voice quality</td>
</tr>
<tr>
<td>very nasal</td>
</tr>
</tbody>
</table>

If normal, you can stop here

3. Production of /a/ "Ah"

<table>
<thead>
<tr>
<th>Visual observation of palate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good movement — closure</td>
</tr>
<tr>
<td>Moderate movement — appears short</td>
</tr>
<tr>
<td>Slight movement — appears short</td>
</tr>
<tr>
<td>No movement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Auditory impression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sounds normal</td>
</tr>
<tr>
<td>&quot;Ah&quot; sounds nasal</td>
</tr>
</tbody>
</table>

4. Production of /pə/ "Pah"

<table>
<thead>
<tr>
<th>Visual observation of palate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintains closure</td>
</tr>
<tr>
<td>Palate appears to drop when the /a/ &quot;Ah&quot; is produced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Auditory impression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sounds normal</td>
</tr>
<tr>
<td>&quot;Ah&quot; sounds nasal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nasal emission of air on /p/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sounds normal</td>
</tr>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snorts</td>
</tr>
</tbody>
</table>

5. Production of /ta/ "Tah," repeated rapidly

<table>
<thead>
<tr>
<th>Sounds normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snorts</td>
</tr>
</tbody>
</table>

6. Production of /ʃ/, prolonged

<table>
<thead>
<tr>
<th>Sounds normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snort</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>/ʃə/ &quot;Fah,&quot; repeated rapidly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sounds normal</td>
</tr>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snort</td>
</tr>
</tbody>
</table>

7. Production of /s/, prolonged

<table>
<thead>
<tr>
<th>Sounds normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snort</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>/sə/ &quot;Sah,&quot; repeated rapidly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Slight nasal emission of air</td>
</tr>
<tr>
<td>Nasal snorts</td>
</tr>
</tbody>
</table>

Bensen noted that if speech is normal during conversation there is no need for further testing. Observation of the velopharyngeal mechanism through the open mouth during /ab/ will reveal palate movement, and, during /pab/, if the palate rises and is making a downward excursion on the /ab/, the patient probably has the potential for closure. Further palate surgery is necessary if there is distinct sound of "cleft palateness" plus no observable movement. Speech therapy should produce near-normal speech when there is good observable movement of the palate, no nasal
emission on plosives, some nasal escape on the fricatives. Speech therapy may help, but additional surgery is probably necessary when there is nasal escape on fricatives and some plosives, with the palate appearing short and motion sluggish and nasal speech during conversation and counting.

**HOOPES**

Dedicated John E. Hoopes of Johns Hopkins Hospital, Baltimore, Maryland, at present divides his life between plastic surgery, training residents and occasionally escaping the former two by going sailing, "deriving an exquisite pleasure from celestial navigation." In 1977 Hoopes wrote:

My interest in cleft palate and resultant speech began in approximately 1964, and was stimulated by the plethora of non-information and personal opinion extant in the literature. It seemed clear that there existed no objective assessment of the results of palatal repair other than listener judgment and it seemed clear that listener judgment could not be compared between institutions; therefore, truly objective assessment of the results of palate repair was not available.

In 1968 in *Plastic and Reconstructive Surgery*, with Jacob Fabrikant, Hoopes noted that methods for objectively demonstrating velopharyngeal function had contributed valuable information, but all had been proved to have certain limitations. They discussed the various methods:

**Direct Inspection**

Direct observation of the soft palate, through a defect secondary to orbital exenteration, was first described by Wardill and Whillis (1935); similar observations were made by Calnan. . . . Although this information has been of value in speech research, there is minimal correlation between the appearance of the velopharyngeal structures and the speech which they are capable of producing.

**Radiography. . . .**

**Cephalometry. . . .** The limitations of the procedure are related to the single film, sagittal plane technique.

**Tomography.** Hage and Brauer utilized tomography to determine the length gained by palate pushback procedures. . . .
Cineradiography. . . Cineradiographic evaluation of velopharyngeal function offers the advantage of direct and measurable visualization of palatal excursion during speech. There exists strong positive correlation between measurements of velopharyngeal closure by the cineradiographic technique and speech ratings. The addition of synchronous sound recording by Bjork is a refinement contributing to the value of the procedure. The major limitation of the technique is that, at present, motion can be observed only in one plane. . .

Nasal Air Escape

Measurement of the quantity of air escaping through the velopharyngeal orifice during speech has played a significant role in the continuing search for a satisfactory method for evaluating speech objectively. Kymographic tracings of nasal air escape were reported by Biebendt in 1908. This area of investigation was pursued by Buncke and Chase. Sophistication of the technique by Warren has allowed the precise calculation of velopharyngeal orifice size. A number of objections have been raised regarding the value of the technique. Spriestersbach demonstrated radiographically that 38 of 47 patients used the tongue and palate, rather than the velopharyngeal sphincter, to valve for puffing. . . . Calnan reported on a group of 225 patients, all of whom exhibited palato-pharyngeal incompetency during phonation, but 85 of whom achieved closure during blowing. McWilliams emphasized . . . speech demands velopharyngeal behavior that is physiologically different from that required for blowing. . .

Acoustic Analysis

The technique of analyzing speech acoustically has been applied to cleft palate subjects only to a very limited degree. Bjork suggested that analysis of sound spectrograms, synchronized with cineradiographs, might form an important basis for assessing speech results postoperatively. . . . Weatherley-White utilized a prototype instrument. . .

Electromyography

Electromyography still remains, at this time, a basic research tool without demonstrated clinical applicability.

THE BIONIC PALATE

Through the work of Hoopes and Fabrikant and Yules, Northway and Chase, functional velopharyngeal relationships were being defined more precisely by means of cineradiography.
Meaningful interpretation of data within the total framework of the pertinent functional anatomical variables called for the construction of a functional mechanical model of a velopharynx. Lee Dellon, with the assistance of John Hoopes, at Johns Hopkins Hospital, constructed a *palate analogue*.

As noted by Dellon and Hoopes in the *British Journal of Plastic Surgery* in 1970:

The palate analogue gives dynamic representation only to the levator and tensor veli palatini muscles and the palatopharyngeus muscle. . . .

The hard palate is represented by a rigid plate which is variable in position with respect to the posterior pharyngeal wall. The soft palate is represented by a flexible elastic structure which is variable in length. The posterior pharyngeal wall is represented by a fixed rigid plate. Three muscles: (1) levator veli palatini, (2) tensor veli palatini, and (3) palatopharyngeus are represented bilaterally by silk ligatures which are variable in length, i.e., can be "contracted". The levator insertion is variable in position throughout the length of the soft palate.

The palate analogue is claimed basically to be a manual analogue computer which is "programmed" to "read out" visually in terms of velopharyngeal incompetence and type of closure after being "fed" such data as levator insertion, depth of nasopharynx, and soft palate length.

Dellon and Hoopes stated:

At the anatomical level, the palate analogue provides a dynamic view of the relationships between structure and function. At the speech pathology level, the palate analogue provides a powerful instructional tool capable of
visually demonstrating the aetiology of hypernasality and nasal emission on the basis of anatomical variables. At the surgical level, the palate analogue provides an objective rationale for the selection of specific surgical techniques best suited to the individual case. With regard to this latter explanation, a patient's cineradiographic data can be converted to palate analogue scale and plotted ... to illustrate graphically which of the anatomical variables are abnormal and to what degree surgical correction is required. Decisions regarding palate lengthening procedures and/or surgical augmentation of the posterior pharyngeal wall can be entered into with precision.

AERODYNAMICS OF THE VELOPHARYNGEAL ORIFICE

Spriestersbach

Duane C. Spriestersbach, dean of the graduate school at the University of Iowa, has had his pioneering work in cleft palate speech pathology facilitated by a remarkable ability to work with, but without threatening, other specialists of his team. In 1977 he recalled the beginning:

While a young, new assistant professor in speech pathology in a department with a long-standing research tradition, the senior member of the faculty responsible for cleft palate resigned, and suddenly I had a great deal of learning to do. My mentor, Wendell Johnson, advised me to concentrate in depth on some aspect of speech production and soon I would identify more questions than I could ever answer. I tried to follow his suggestion and have never run out of questions. Dean Lierle, the head of the Department of Otolaryngology, gave me an appointment in his unit and started me on my way working in interdisciplinary environments.
A colleague in our department had developed a detailed, systematic interview technique for studying the families of children who stuttered. This was adapted to the study of families of children with clefts, and on the third try, N.I.H. agreed to support an extensive study of the psychosocial aspects of the "cleft palate problem," which included medical, dental, speech, audiometric, radiographic and psychological examinations. Previous speculation about effects of poor physical development of the child with a cleft questioned respiratory supply and control. A wet spirometer gathering dust in the laboratory was mobilized for measurements and the patients, of course, had to hold their noses. We took measurements both with the nostrils closed and open and later began to see a relationship between the ratio of closed and open measures and the adequacy of speech articulation. Out of this effort, not unlike the fortuitous roasting in Lamb's *Dissertation on Roast Pig*, grew the development of the oral manometer with a "bleed" that provides a clinical measure of the efficiency of the velopharyngeal valve used today.

Since our psychosocial study was long-range, we found ourselves dealing with peripheral data and were embarrassed for ourselves and others for the unwarranted assumptions about the homogeneity of cleft populations in previous research. Our growing insight about this reality caused us to look for better specifications of the physiological requisites for adequate speech, appreciating the variances that could exist within the functions of the several structures responsible for the total speech mechanism.

Frequently, when one asks a surgeon (or dentist or speech pathologist) how he or she accounted for a particular superior result, the answer is, "Well, in my hands. . . ." This is not where the communication should end. Clinical research is difficult but no less inherently scientific than basic research; every clinician is a researcher who should communicate, test and validate. The consequences of such an approach improve our chances for expanding the body of knowledge on which the quality of our lives, and perhaps our survival, depends.

*Warren*

Donald W. Warren, chairman of the Dental Oncology Department, University of North Carolina School of Dentistry, was brought up in the Flatbush section of Brooklyn and went south to the University of North Carolina at age 17 with his belongings packed in a laundry bag. During his dental school days, he married a young lady with a love of horses. After he learned to ride, he became interested in fox hunting and ended up president of the Red Mountain Foxhounds out of Rougemont, North Carolina. As he says:
After a hard day at the orifice (velopharyngeal, that is), I usually take off on my horse for a few hours of unwinding. Erle Peacock told me it was an adolescent trait that would not last. However, the last time I saw Erle, he mentioned that he bought a horse and now rides off into the sunset around the mountains of Tucson.

While studying at the Lancaster Cleft Palate Clinic, Warren became interested in palate studies. Using measurements of airflow through the nose and air pressure in the mouth in a ratio, he developed a formula that can predict the size of the velopharyngeal port. In 1977 he wrote his thoughts on this in cleft palate:

The effect of cleft palate on the respiratory components of speech was recognized long ago and a number of crude devices have been developed to provide a gross assessment of palatal function. These devices include, among others, Utube manometers, mirrors which record nasal fogging, and various blowing devices which, at best, provide a gross indication of nasal escape.

The use or abuse of assessment tools depends to an extent on the clinician's understanding of the effects of palatal incompetency on speech performance. Complete separation of the nasal and oral chambers should occur for all consonants except m, n, and ng. However, normal voice quality and intelligibility can still be achieved in the presence of very, very small openings. Studies indicate that some normal speakers may have palatal openings of 1-3 mm.² for non-nasal consonants during speech. Usually, however, the sphincter is tightly closed.

In cleft palate individuals, the upper limit of velopharyngeal adequacy is approximately 20 mm.², although in most instances it is as small as 10 mm.². The reason for this variation is that many other factors affect speech performance besides palatal closure. For example, in the range of 10 to 20 mm.², the position of the tongue and mandible during phonation influences the amount of air which leaks into the nose. High tongue position impedes airflow through the nose and mouth and since air will flow through the region of least resistance, this results in greater nasal emission through the palatopharyngeal opening. Similarly, greater effort during speech also increases nasal emission of air, regardless of the size of the palatal opening. While the range of adequacy varies up to 20 mm.², greater than 20 mm.² is always inadequate for normal speech.

The effects of tongue placement and other compensatory phenomena associated with clefting are emphasized because in most instances, the measurements obtained by simple manometric tools such as Utube manometers and blowing devices are influenced more by these activities than the degree of incompetency present. Thus, an instrument which measures
nasal emission of air alone may reflect effort more than palatal competency.

In addition, many of these measurements are made during non-speech activity such as blowing or sucking, and individuals with incompetent closure can sometimes perform these activities satisfactorily utilizing lingual-palatal contacts.

The problems associated with simple devices do not negate their use providing the clinician realizes the possibility of artifacts, especially in the borderline incompetency range.

Recognition of these problems has led to the development of more elaborate, complicated and expensive instruments for objective evaluation of cleft palate speech. The basic components of the aerodynamic measuring systems are flowmeters which record volume rates of airflow and pressure transducers which record airway pressures within the vocal tract. Used individually, these instruments are subject to the same inaccuracies as the less expensive devices. For example, flowmeters have been used to estimate velopharyngeal competency under the assumption that nasal airflow is linearly related to palatal function. However, there is good evidence that this assumption is not true. The same problem of contamination by compensatory phenomena is present with these instruments when used alone.

When flowmeters are used in conjunction with pressure transducers, velopharyngeal function can be separated from the influence of compensatory adjustments by other vocal tract structures. Hydraulic equations have been used to measure such parameters as velopharyngeal orifice size, nasal airway resistance, oral port opening, and the timing of consonant production in order to identify the compensatory adjustments, most often maladjustments, which occur in response to incompetent closure.

The advantage of techniques which directly measure the size of the sphincter is obvious, since this is precisely the information that the surgeon should know. Comparison of preoperative and postoperative speech samples is not an effective method of evaluation, since poor articulation may remain even after successful surgery, thereby masking the surgical result.

The drawback to this approach is that the instruments are more complex than the average clinician desires, and a compromise between simple devices and sophisticated techniques is desirable. This means that a manometric instrument should be simple to use, inexpensive, and able to delineate palatal function from other articulatory influences. The solution is to use an instrument which records the difference between oral and nasal pressures during plosive consonant production, such as the /p/ sound. A zero pressure obtained with this differential pressure transducer technique means that the palatal function is so minimal that pressure in the nose equals pressure in the mouth, or there is no functional separation between the cavities. As the palatal mechanism improves in its ability to achieve closure, the pressure
difference rises. Utilizing this instrument during production of plosive consonants eliminates the effects of tongue and mandibular position, since the oral cavity under these circumstances encloses a stagnant column of air. Similarly respiratory effort would have no effect since a difference in pressures, both influenced by effort, is involved. This allows the surgeon to evaluate palatal function directly, rather than recording some indirect parameter somewhat related to the individual's speech performance. Limiting assessment to the palatal sphincter is the only valid way the surgeon can judge his specific contribution to the speech habilitation process.

Postoperative suction test

There is an immediate postoperative test which is a reverse aerodynamic challenge of the velopharyngeal seal, used for many years by a multitude of surgeons to estimate the effectiveness of the palate surgery and predict the eventual, or potential, velopharyngeal closure. In 1972 David Sullivan of Spokane wrote about this palate suction test:

The suction test, which I learned from Mr. Moore and which I find very useful, may not be original with him. A metal suction tip is introduced well back in one nasal cavity, then the hole in the suction tip and both nares are occluded while watching the velopharyngeal opening from the oral side. In a positive test the soft palate, posterior pharyngeal wall, and the sidewalls of the nasopharynx are quickly and readily pulled together to form an air-tight seal. This test is carried out before starting the operation. Presumably if it were positive at that time, there would be no indication for the operation. In practice, the test is always negative. If, after surgery, the test is positive, the surgery is over.

This is indeed an excellent guide and, although I have been using the suction test for years, I cannot say who first used it.
In 1948, I had the unique opportunity to visit Victor Veau’s Hôpital Saint-Michel and to talk with his speech pathologist, as reported in “Plastic Peregrinations,” 1950.

No one is in a better position to judge Veau’s palates than the devouté Madame Borel-Maisonny, his speech therapist for twenty-five years. Often as early as two weeks following surgical closure of the palate, Madame Borel evaluates the result. A 20 cc. syringe of liquid barium is injected into the naris, thus coating the nasal surface of the palate. With the patient’s profile under fluoroscopy, the different positions of the palate during certain fundamental sounds are marked on tracing paper. It is possible for Madame Borel to predict the prognosis of each palate, prevent adenoidectomies when that excess tissue is needed, prescribe obturators when the palate is insufficient in length. She says she has been able to obtain normal speech results in 74% of Veau’s palate cases. In some of these cases it was necessary to fit an obturator against the pharyngeal wall for the short but mobile palate to play against for normal speech. Then there were always the few short and scarred palates from which normal speech can never be formed.

It is interesting that 25 years later there was only a 1 percent improvement over Veau’s palate results. In 1973 Hughlett L. Morris of the University of Iowa reviewed the literature between 1960 and 1971 to determine the percentage of patients with velopharyngeal competence, as judged by “speech results” following primary cleft palate surgery. He concluded:

A success rate of 75% seems reasonable in estimating the velopharyngeal competence results from primary cleft palate surgery, although it is apparent that the success rate is influenced by many factors.

Yules

In 1968 in Plastic and Reconstructive Surgery Richard B. Yules, while still a resident, with William H. Northway, Jr., and Robert A. Chase of Stanford University School of Medicine, reported quantitative data accumulated from routine sound cineradiography of 68 cleft palate patients, 24 velopharyngeal incompetent patients and 34 controls. A standard speech test was used, consisting of vowel and consonant sounds, single words (designed to test linkage of vowel and consonant sounds), connected speech,
spontaneous speech, blowing and swallowing. Lateral studies were performed by single-frame and sequential-frame analyses, utilizing a Kodak cine-analyzer projector. Measurements were determined directly from the image projected onto a paper screen and corrected for the magnification present in each frame, as indicated by the metal marker disk. Eight separate measurements were determined:

1. HPA: the hard palate to atlas distance of the posterior nasal spine (pns) to the mid-anterior atlas (pns-g)
2. HPP: the hard palate to posterior pharynx distance, or distance along a line drawn through the anterior (ans) and posterior nasal spine to the posterior pharyngeal wall (pns-e)
3. SPL: the soft palate length, or distance from the pns to the soft palate tip (pns-a)
4. EPL: the effective palate length, or the length of the soft palate in the plane of velopharyngeal closure (pns-f)
5. SPT: the soft palate thickness taken perpendicular to the SPL line at its thickest point (l-m)
6. RDUP: the resting distance from uvula or soft palate tip to the pharynx, taken on a line parallel to the HPP (a-d)
7. QDUP: the distance of the uvula from the pharynx when the soft palate was maximally stressed for velopharyngeal closure, i.e., while saying the word "quack" (b-c)
8. RDPA: the resting distance from the pharynx to the atlas, taken from the point of closure or expected closure on the posterior pharyngeal wall to the atlas (f-g)

No statistically significant differences in measurements were obtained by age or sex grouping. Certain other important differences were, however, noted:

Control soft palate length was shown to be longer than in cleft palate and velopharyngeal incompetent patients; hard palate to pharynx distance was increased in velopharyngeal incompetent patients, compared with controls and cleft palate patients. . . . Routine sound-synchronized ciné-radiography is in itself dramatic in a descriptive sense; it will become most useful when it is quantified to the extent that the surgeon may choose from a given set of operations and a speech therapist choose his therapy from quantitative data which will allow prognostication.
For years Sam Berkowitz has been carrying out lateral cephalometric evaluation of velopharyngeal function in our cleft palate clinic. Here are some of his 1977 comments:

Cephalometric roentgenology has contributed static and dynamic data of interest to the speech physiologist. It has been utilized to study variations on the depth and configuration of the oral and pharyngeal cavities, and in the measurement of the adenoid and soft palate. Understanding the dynamics of growth and development of the nasopharyngeal spaces and their contiguous organs is essential for a proper evaluation of the speech mechanism. Many studies have emphasized the need to appreciate the structural variations that

Incompetent velopharyngeal closure

At rest—velum lying on dorsum of tongue

Vocalizing "Youuu..." velum elevates but fails to make contact with adenoid

Incompetency due to velar paralysis

Neuromuscular malfunction evidenced by failure of soft palate to elevate while phonating "Youuu..."
might exist in the intra-nasal and pharyngeal architecture of infants with various clefts of the lip and palate.

The lateral cephalograph is an excellent diagnostic tool to assess the capabilities of the patient to perform proper velopharyngeal closure in the anteroposterior dimension. It has permitted the clinicians to appreciate the significance of the variations in the dimensions of the pharynx and pinpoints those factors which determine the success or failure in obtaining proper air flow control and which might be beyond the influence of the surgeon's skill. It is impossible to assess velopharyngeal closure by preoral examination due to the abnormal posture of the head and the line of visual inspection. It has been stated that cephalometric films can provide single point-in-time estimates of velopharyngeal function that agree rather well with cinefluorographic observations with sounds s and u. It appears possible to make meaningful generalizations concerning dynamic aspects of speech from cephalometric data.

Three head plates are taken: one at position rest, the second during sustained phonation of the vowel u ("Youuu..."), and the third while saying s ("sss..."). These films reveal information related to:

- Vocalizing u
- Vocalizing s

**Stretch reflex:** the ability of the soft palate to increase in length during function.

![Stretch reflex](image)

Left. Incompetent closure when vocalizing "Youuu..." Right. Soft palate now makes contact when vocalizing "sss..." because of its increase in length. These patients are amenable to speech therapy and need not have palatal surgery unless all else fails.

1. length of velum at rest and in function
2. variations in the skeletal framework that determine the outlines of the nasopharynx
3. relationship of the adenoid tissue to the nasopharynx
4. the neuromuscular functional capabilities of the pharyngeal musculature.

995
**Nasopharyngeal Configuration**

Velopharyngeal valving is dependent not only on the sensory-motor adequacy of the velum and synergistic musculature, but also upon the morphologic dimensions of the nasopharyngeal port. The size and shape of the nasopharynx is determined by the contiguous osseous anatomy of the maxilla, cranial base and vertebral column. Various anomalies of the cervical vertebrae, such as fusion of C2 and C3, occipitalization of the atlas, malformation of the anterior tubercle of the atlas, and malposition of the atlas, increase the pharyngeal depth and are often seen in patients with congenital palatopharyngeal incompetence (CPI).

![Diagram of cervical vertebrae](image)

**Normal radiographic anatomy of the cervical vertebrae**

Malformation of the atlas associated with an increase in the AP pharyngeal dimension. Pharyngeal flap used to correct velopharyngeal incompetence. *Note:* Posterior pharyngeal wall being pulled forward during function.

**Variability of the Anteroposterior Pharyngeal Dimension**

Ricketts demonstrated that problems in the cranial base and skeletal structures, rather than in the palate alone, can be responsible for cleft palate.
speech. Deep retropharyngeal dimensions are often coexistent with obtuse cranial bases which distally position the cervical spine relative to the maxilla. He demonstrated that there can be cleft palate speech if there is a deep retropharynx with or without adenoid tissue. Yet, in another case, without adenoid tissue but with a shallow retropharynx (due to an acute cranial base which brings the cervical spine closer to the maxilla, and/or due to an exceptionally large anteroposterior maxilla), there might be normal speech. The utility of the adenoid tissue in velopharyngeal closure is related to the overall dimensions of the nasopharynx. If the adenoid is exceptionally large and/or close to the posterior nasal spine of the maxilla, it may block off the posterior nasal choanae and cause nasal atresia with denasal speech.

As the face grows, the palatal plane (pp) descends away from the anterior cranial base (NS), affecting the pharyngeal depth. This dimension increases with growth. (Berkowitz, S.)

Subtelny has demonstrated that the AP pharyngeal dimension increases with growth and the soft palate has to span a greater distance in order to make contact. Hypermnasality, therefore, can occur at a later date with or without adenoidectomy.

Atrophy of Adenoid Tissue

Atrophy of Adenoid Tissue

<table>
<thead>
<tr>
<th>Age 9</th>
<th>Age 14</th>
<th>Age 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtelny</td>
<td>Subtelny</td>
<td>Subtelny</td>
</tr>
</tbody>
</table>

T.B.
- Age 9
- Age 13
- Age 25
Not all cleft palates have inadequate velopharyngeal function. The pharyngeal dimensions are not related to the cleft type, but are influenced by the effects of surgery.

Adequate velar closure in bilateral cleft lip and palate due to a very well-developed maxilla coupled with a very shallow pharyngeal space is shown. Although this dimension increased slightly in six years, velar closure remained competent.

Mid-facial hypoplasia was brought on by non-physiological surgery. Maxillary size was reduced in all three dimensions, resulting in an anterior dental crossbite, erroneously diagnosed as being due to an oversized mandible. Failure of the maxilla to develop in the anteroposterior dimension increased the depth of the pharyngeal space, causing velopharyngeal incompetence.

*The Pharyngeal Flap Procedure*

Many excellent reports support the continued use of this procedure for the correction of hypernasality. It has been our experience that a wide superiorly based flap is the surgical procedure of choice, especially when the palate is scarred.

Case A

Velopharyngeal incompetence seen when vocalizing "Yowau..." After surgery; note pharyngeal wall being pulled forward
Incompetent closure on vocalizing "Yoyuu..."

After surgery; posterior pharyngeal wall being pulled forward during function

**Videofluoroscopy**

M. Leon Skolnick of the University of Pittsburgh has achieved a breakthrough with a multiview videofluoroscopic technique. He reminisced in 1977:

According to my medical school classmates, I chose radiology in order to pursue my favorite hobby, photography, so that I could continue to enjoy my love of highlights and shadows. I became involved in radiographic studies of speech shortly after I arrived at the Upstate Medical Center in Syracuse, New York, in November, 1967. The radiology department had been providing lateral cine studies of cleft palate patients but none of the radiologists were interested, so, as the newest member of the department, this task was given to me like a hot potato. I began to attend the weekly conferences of the cleft palate clinic and, as a result, a growing rapport developed. I am indebted to plastic surgeons David Stark and Alfred Falcone and speech pathologist Gerald McCall for their interest and encouragement.

Soon I began to realize the limitations of lateral cine studies. These studies were initially performed without barium and the soft tissue detail was often poor. Specifically, one could not always tell whether closure was occurring or whether a small gap was present. In addition, though the children were speaking, these were silent cines. We had no way of indicating what sounds the patients were producing as the films were taken. While searching for ways of recording sound and roentgen images simultaneously, I happened upon a beautiful and dust-covered 2" Sony video tape recorder, then a microphone, and lo and behold, I could record roentgen images and speech simultaneously on video tape! In addition, since I was able to play back the images immediately, I wheeled the video recorder into the cleft palate clinic to show the physicians the results of studies performed the same
day. What a fantastic effect this had on everyone! Now I too could participate in the clinical evaluation of the patients and present my findings, the fluoroscopic study of the pharynx on video tape. Often lively discussions ensued because the clinicians observed one thing intraorally and I demonstrated something different videofluoroscopically. They began to realize the limitations of their physical examination and place more value on the fluoroscopic study.

A major source of information that was not provided by the lateral film was information on movement of the lateral pharyngeal walls. The need for this information was stressed by the plastic surgeons. I settled on barium as the best contrast agent because of its acceptance by the patient and excellent coating. Initially, after examining sagittal specimens of cadaver head and neck, I realized that the view that would visualize the palate and pharyngeal walls at one time would be one looking down through the velopharyngeal portal. I first obtained an intact head and sectioned it in a transverse plane just above the hard palate to visualize the plane of the velopharyngeal portal more carefully, and then had to devise the optimal patient positioning for this view. Obviously, one needed a cooperative subject who would tolerate holding a variety of uncomfortable positions so that I could determine which would be most satisfactory—my wife, Irene! By the spring of 1969, the base view was born and soon perfected. One comment about my presentations at national meetings is in order. Except for my first paper presented at the Radiologic Society of North America in December, 1968, all my subsequent presentations were at cleft palate or plastic surgery meetings. Several papers submitted to national radiological meetings were rejected. In the radiological field, I was somewhat of a peculiar fellow.

In 1969 Skolnick used videovelopharyngography in patients with nasal speech with emphasis on lateral pharyngeal motion in velopharyngeal closure. In 1970 he used videofluoroscopic examination of the velopharyngeal portal during phonation in lateral and base projections. In 1972 he studied velopharyngeal competence and incompetence following pharyngeal flap surgery with videofluoroscopy in multiple projections. Finally, in 1973, with McCall and Barnes in the Cleft Palate Journal, he described the various patterns and configurations that the sphincteric mechanism exhibited in a group of 85 non-nasal and nasal subjects without pharyngeal flaps. These patients were studied with his multiview videofluoroscopy (lateral, base and frontal views) after the nasopharynx was coated with barium.

Skolnick presented a schematic view of the normal pharynx showing the sphincteric mechanism of velopharyngeal closure.
from the lateral, frontal and base radiographic projections. The
dotted lines represent the velum and pharyngeal walls at rest; the
heavy solid lines show the same structures during velopharyngeal
closure. Skolnick noted:

Observe on the lateral view that the velum elevates and elongates posteriorly
during phonation. . . . It should be emphasized that the frontal view is
useful because it best demonstrates the vertical extent of the pharyngeal
portion of the velopharyngeal sphincter. However, the base view which
permits visualization of the portal en face is required to appreciate the total
sphincteric concept of velopharyngeal closure.

Skolnick also presented sketches of sphincteric closure of the
velopharyngeal portal in a normal subject seen from base view,
presenting the portal at rest (A), during partial closure showing a
coronal pattern developing as the velum moves posteriorly and
the pharyngeal walls contract centrally (B), and at full closure
producing a coronally oriented slit (C).

In both non-nasal and nasal subjects, Skolnick found multiple
patterns of sphincteric closure. The multiple patterns result from
variations in the relative contributions of the velar and pharyngeal
movement components to the closure mechanism. His
diagramatic outline of the VP sphincter presents the velopharyngeal
portal at rest (on the left), at partial closure (in the middle)
and at full closure (on the right).

A portrays a normal subject showing convex projection of the
uvula portion of the velum into the velopharyngeal portal at rest.

B presents a postoperative cleft palate showing absence of the
uvular muscular bulge at rest, with a coronal pattern of closure
similar to the normal.

C shows a postoperative cleft palate with circular closure
pattern.
He concluded:

However, it is clear that multi-view video or cinefluorography offers an adequate approach for the examination of the sphincteric mechanism ofvelopharyngeal closure. It behooves us to begin taking the necessary steps required to incorporate this roentgen procedure into our clinical protocol if at all possible. Therefore, think sphincter!

In 1975, with Shprintzen, McCall and Rakoff, Skolnick examined in multiple videofluoroscopic projections 30 postoperative cleft palate patients (2 to 12 years of age) with normal speech to assess velopharyngeal closure in three dimensions. They found:

1. All 30 subjects exhibited contact between the superior border of the velum and the adenoid mass in the nasopharynx.

2. All 30 subjects showed good localized medial movement of the LPW at the appropriate plane of the hard palate.

3. 10 out of 30 subjects, 33%, had a Passavant’s Ridge during speech. All 10 of these subjects utilized the ridge as a point of closure, as well as the adenoids.

4. The observed patterns of closure were consistent across varied consonant utterances.

5. The mechanism of velopharyngeal closure in this group of subjects is essentially the same as for normal adult speakers and differs only anatomically due to a lack of head growth in children.

In 1977, upon request, Skolnick forwarded some photographic illustrations of his multiview fluoroscopic studies of cleft palate:

D shows a postoperative cleft palate with circular closure pattern and Passavant’s ridge. (Ridge is represented by stippled and lined area in middle and right columns.)

E shows a postoperative cleft palate with sagittal closure pattern.

Skolnick’s stinging logic emphasized:

The articulatory and resonance characteristics of a patient’s speech are valid indicators only of (1) the presence or absence of velopharyngeal incompetence and (2) the consistency or inconsistency of the incompetence. The speech symptoms provide no information about the precise defects in a patient’s velopharyngeal mechanism that is producing his incompetence. We believe it is vital to know these precise defect(s) in a given patient’s velopharyngeal closure mechanism prior to undertaking procedures to correct the abnormalities producing the deviant speech, whether by surgery, prosthetic devices or speech therapy. Only by this means can the treatment be adequately tailored to the needs of an individual patient and the results then objectively assessed.

He concluded:

However, it is clear that multi-view video or cinefluorography offers an adequate approach for the examination of the sphincteric mechanism of velopharyngeal closure. It behooves us to begin taking the necessary steps required to incorporate this roentgen procedure into our clinical protocol if at all possible. Therefore, think sphincter!
Lateral and base views of repaired cleft palate with coronal type of velopharyngeal insufficiency on base view.

Patient with pharyngeal flap who demonstrates bilateral incompetence after surgery. Lateral and frontal views during quiet breathing (B) and phonation of e (e) are presented. Note on the base view that even with phonation, both lateral portals remain open.
Lateral and base views of patient after pharyngeal flap with unilateral portal incompetence. B represents quiet breathing; e represents phonation of this sound. Note on the base view that the left portal completely closes and the right portal, though reduced in size, still has a small opening through which air escapes.

Lateral and frontal views during breathing (B) and phonation of e (e) of a repaired cleft palate in a patient with velopharyngeal incompetence. No pharyngeal flap is present. On base view during phonation, portal decreases in size, but a large coronal defect remains.
Lateral and frontal views of patient with a pharyngeal flap during breathing (B) and phonation (S) who demonstrates satisfactory closure of the portals on either side of the flap. The base view during breathing demonstrates a central narrow flap and bilateral open portals. During phonation the portals close against the edges of the flap. Arrows indicate the open portals during breathing. Arrowhead indicates position of flap during both breathing and phonation.

Lateral, frontal and basal views during breathing (top row) and during phonation (bottom row) of normal subject. During phonation velum elevates and touches posterior pharyngeal wall on lateral projection. On frontal projection localized medial movement of lateral pharyngeal walls is seen in nasopharynx (horizontal arrows). On base view the barium-marginated oval seen during quiet breathing centrally contracts to close the velopharyngeal portal in a coronal closure pattern. Arrows indicate the region of the closed portal. Barium lateral to arrows represents barium squeezed above and below the level of the portal during closure.
ENDOSCOPY

Of course, the best method of studying the function of the velopharyngeal sphincter during speech would be under direct vision. Although this has been possible in rare cases after removal of a portion of face and maxilla during extensive tumor ablation, such action is a bit radical for routine postoperative cleft palate evaluation. The next best view of the sphincter is offered by endoscopy.

Oral

According to Pigott, Madame Susanne Borel-Maisonny of Paris published findings of oral endoscopy in cleft palate in 1937. In 1966, in the Cleft Palate Journal, Stanley Taub of Brooklyn, New York, a self-taught ventriloquist with a natural interest in the mechanisms of speech, reported that in 1962, as a resident at Kings County Hospital, he had developed the oral panendoscope. This instrument is an integrally illuminated, tubular optical device with a lens system which increases the light transmission from the objective prism to the viewer and camera at the proximal end. A high-intensity incandescent lamp adjacent to the objective lens illuminates the target surfaces at proper levels of light, as required for direct observation, motion picture and still photography. An eyepiece is provided with a glare shield for clinical use and a threaded adapter for camera mounting. A nylon removable tongue depressor functioning as a heat shield is fitted to the instrument. The oral panendoscope is inserted into the oral cavity with the objective lens up and is manipulated for viewing the posterior pharynx and nasopharynx. The muscular activity of the palatopharyngeal sphincter mechanism is clearly observed while the patient recites various combinations of vowel-consonant-vowel sounds. The mouth may be closed with the instrument inside, providing visual observation during phonation. Excited by the visualization of the nasopharynx, Taub exclaimed:

My joy at viewing this area could be compared to looking at the dark side of the moon!

and concluded:
The Taub oral panendoscope ... creates the opportunity for improved diagnosis, treatment and research, by providing a tool and method for simultaneous visual observation and audio-visual recording of the operation of the speech mechanism during the production of speech sounds in normal and abnormal subjects.

Nasal

Ronald W. Pigott, a deft left-handed, imaginative and artistic Irishman who played hockey for Ireland (British Combined Services) and tennis for the University of Dublin, came to the University of Miami in 1967 as a Robert W. Johnson Fellow. He became interested in the direct visualization of the velopharyngeal sphincter. The versatility of fiberoptic instruments opened new possibilities when, finally, the American Cystoscope Company's Infant Urethroscope (overall diameter 3 mm.) was found suitable to pass through the infant's nostril. With University of Miami speech pathologist Jack F. Bensen as an educated subject, Pigott, in 1969 in Plastic and Reconstructive Surgery, presented his method of nasendoscopy utilizing 1% cocaine spray. The "patient" lay in a semi-recumbent position in a dental chair equipped with a headrest so that the surgeon could be positioned as in surgery. Speculum exposure allowed the scope to pass gently into position, and mucus was suctioned until the posterior border of the soft palate and the posterior pharyngeal wall can be seen 1-3 mm before the tip of the instrument contacts the posterior wall.

Bensen went through standard test phonetics on 25 normal subjects ranging from 11 to 45 years of age while Pigott observed the palate and pharyngeal walls and noted the following:

At rest

1. The enormous bulk of the musculus uvulae could be seen. The majority of subjects had a large ridge down the soft palate.
2. The levator sling can be detected.
3. The side of the ridges of the salpingopharyngeus varied enormously.
4. The eustachian orifice could be examined easily. Occasionally, movements inside it could be seen, with opening and closure of the tube.

During Speech Movements

Extremely rapid movements were made. The levator sling could be seen to tighten into a bar, throwing the convexity of the musculus uvulae bulge
up and back to fit into the concavity of the posterior superior pharyngeal wall. In normal rapid speech, almost no lateral or posterior wall movements seemed to occur. Sometimes the levator ridge hardly seemed to contact the pharyngeal wall, but the contracting musculus uvulae flipped the passive free margin of the palate back into contact, where it stuck momentarily to the pharyngeal wall, before dropping away (as the levator relaxed). The lateral gutters (noted in 1880 by Falcson and confirmed from below by Taub) were occasionally seen . . . sometimes leaving a gap apparently 2-3 mm in diameter. . . . These lateral gutters were blocked by medial movement of the salpingopharyngeus in many subjects, though escape of air below the level detectable by ear has been found by Bjork and Nylen and by Warren.

As nasendoscopy allowed unobstructed observation of the nasal surface of the velopharyngeal valve without interruption of speech, Pigott, with Bensen and White in 1969, was able to report interesting findings and treatment suggestions in velopharyngeal incompetence. Asymmetrical velopharyngeal closure suggested a pharyngeal flap on the open side; a pharyngeal flap ineffective on one side called for a second flap on that side; midline gaps suggested pharyngeal flaps; the lack of a salpingopharyngeal fold and poor lateral gutter closure suggested a Hynes pharyngoplasty. One pharyngeal flap, appearing narrow to the surgeon but presenting normal speech to the pathologist under endoscopy, was shown to be broad above, leaving slit-like orifices which closed with mere palate flicking, proving that an adequate flap reduces the velopharyngeal opening to a size controllable by meager palate movements. Light palate contact against large obturator suggested gradual reduction in size of obturator or quicker improvement with a pharyngeal flap; pushbacks with island flaps showed mobility, normal speech and firm closure if the island had blended imperceptibly with the surrounding tissues, but examples of partially extruded islands indicated need for through-and-through sutures between the island and mucoperiosteal flaps during surgery. Inconsistent closure, but with mechanisms for consistent closure present, offered a good case for postponement of surgery. Pigott also noted the high percentage of almost completely atrophic musculi uvulae in these patients, coinciding with Broomhead’s finding that the lesser palatine nerve serving this muscle is routinely cut in pushback operations.
when the aponeurosis is freed from the edge of the hard palate. This emphasized the importance of trying to preserve these nerves during the dissection.

At Frenchay Hospital, Bristol, Ron Pigott continued to develop his nasendoscopy, properly renamed “nasal pharyngoscopy” by Huffstadt of Gröningen. He was joined by A. P. W. Makepeace of the Audio-Visual Aids Unit, University of Bristol, whom Pigott describes as

an audiovisual eccentric, a scientific magpie who knows more sciences and medicine than one would believe possible without a degree. He devised the split screen videotape recording.

In 1975, in the British Journal of Plastic Surgery, Pigott and Makepeace described their technique of recording nasal pharyngoscopy to aid memory and improve clinical care and research. Improvement in topical anesthesia was achieved by an intravenous cannula with a wisp of cotton wool held on to the tip with Micropore tape and saturated with 4% lignocaine. Most children over 8 years old were found to cooperate. The Storz-Hopkins nasopharyngoscope was introduced somewhat as previously described.

In recording sessions the endoscope coupling is fixed to the endoscope eyepiece before the procedure starts and the Lavalier microphone suspended by a cord round the patient’s neck. . . . The television camera, suspended in a simple gimbal and coupled to the suspension shackle by a snap hook is advanced so that the magnetic coupling can find its automatic location on the eyepiece. . . . With a minimal movement of the head the examiner can watch the monitor while a videotape recording is made, in this case simultaneously with the lateral pharyngeal X-ray.

Pigott tests forced closure on pah-pah-pah, tab-tah-tab, sab-sab-sab, and then asks the patient to count up to 20 quickly. He notes:

Where closure is achieved on the isolated tests, it may be deduced that the potential of speech education exists. Failure of closure will be seen on rapid counting especially in the second 10 when muscle fatigue and loss of concentration often expose weakness. Total, central, bilateral or unilateral defects may be noted. Movement may be present in all walls, any or none, and the operative plan should take account of this.
In the 1975 *British Journal of Plastic Surgery*, B. C. Sommerlad, E. J. Hackett and J. Watson of the London Hospital and St. Andrew’s Hospital, Essex, presented a simplified method of recording. They noted:

The endoscope about to be introduced is connected by the fibre-optic teaching aid to the special lens on the camera (on stand) and by a twin fibre-optic light cable to the light source (on the left of the picture). The videotape recorder with its small attached screen is beside the light source.

They concluded:

In view of Pigott’s work, it would appear that a pharyngoplasty without prior pharyngoscopy is similar to an operation on the bladder without cystoscopy. Now that a simple method of recording . . . is available, we hope nasal pharyngoscopy will become a routine examination in patients with speech defects.

In 1977 Pigott acknowledged:

Recording is now facilitated using fibre-optic teaching attachment between television camera and endoscope as suggested by Sommerlad and Hackett. This has been a big step forward and means that any patient who can be endoscoped can be recorded . . . Failure to endoscope patients over twelve years of age is negligible. Between eight and twelve, success rate is about nine out of ten, and between three and eight years, about three out of four. The youngest children who find cooperation for endoscopy most difficult do well with basal x-ray assessment. Yet not all patients have flexible enough necks to achieve correct position for basal studies and these are the older patients easier to scope. Mucus coated with barium creates serious artefacts occasionally which leads to the wrong diagnosis. Whenever possible, both endoscopy and x-ray should be used.

At the 1975 International Congress in Paris, I challenged Pigott to get me action photographic records of various methods with his nasopharyngoscope. At the 1977 International Cleft Palate Congress in Toronto, where he was giving a seminar on nasopharyngoscopy, he presented me with the coveted photographs which are displayed with captions in the margin. Pigott summarized his 10-year experience:

*Some specific observations are:*

Flaps don’t always stay the size they are cut and their base migrates. Orifices don’t always stay the size they are left. So, accurate planning is
wishful thinking in many cases. Successful flap cases leave relaxed ports far smaller than the normal isthmus so nasal resonance is adversely affected. No successful pharyngeal wall implant case has yet been recorded by me for a defect greater than 0.5 cm.² By success, I mean that there is no nasal escape. I do not accept "improvement" as "success" because of the difficulty in grading, whereas it is relatively easy to say there is, or is not, nasal escape.

It is not true that audible nasal escape ceases below a port size of 20 mms.² Passavant's ridge is a stress phenomenon which disappears with adequate palatal lengthening. I suspect but cannot prove that the lateral wall movement of so-called normal speakers is also a stress phenomenon in compensation for minor degrees of pharyngeal disproportion.

Pharyngeal disproportion exists at the same time as cleft palate. So highly competent surgeons doing excellent standard repairs will find to their chagrin that the palate, though mobile, is incompetent, just as isolated pharyngeal disproportion palates are incompetent.

Why not do primary pharyngoplasties? Well, they have their disadvantages. Reduced nasal resonance, catarrh. They don't always "work." They increase the operative time and anyway, most experienced surgeons achieve 80% +/− 10% palatal competence without. What we need is to recognize pharyngeal disproportion. So far as I know we still cannot be sure which is which.

What benefit have I had from ten years of fairly intensive experience in this field?

1. Speech Assessment: I see what I hear. The visual feedback finds me in a strong position to know what nasal escape sounds like. That is to say, if the
Isthmus is firmly shut, what I'm hearing is NOT palatal incompetence and I can state that more objectively than the speech therapist and back the statement with a video tape. It is not infrequent for articulatory faults of cleft palate speakers, such as glottal stops and velar fricatives, to be thought synonymous with palatal incompetence. This is unfortunate because it leads to disappointment that a given pharyngoplasty does not “cure” articulatory fault habits. At best it merely paves the way. Surgeons, trainees, parents, patients (and even an occasional speech therapist) do not always understand this. So people continue to report “speech” and intelligibility improvements as the result of pharyngoplasty, not palatal competence—surely muddled thinking. Or, it may be a failure to realise that this is a simple valve which is open or shut; air does or doesn’t go up the nose at the wrong time, and is or is not audible.

2. “Best Buy” Pharyngoplasty: In my experience the majority of defects are reasonably symmetrical. About five out of six have enough lateral wall movements for closure of the lateral ports against a good pharyngeal flap. About five out of six, not necessarily the same ones, have enough soft palate lift to close if the palate and pharyngeal wall are brought near enough to each other. About two-thirds have a closure defect of the central third of the relaxed orifice and of these, about a quarter have only a gulley in the midline, equivalent to atrophy of the musculus uvulae (which is never well developed in the cleft palate patient). Of the remainder, about a sixth have a defect of two-thirds of the relaxed orifice and about a sixth have a total lack of lateral wall adduction. Of these it has occasionally been noted that midline contact is achieved, but lateral gutters remain patent. The ideal technique should therefore be most effective in ensuring midline closure. Lateral flap techniques such as Hynes, Orticochea and Moore are least effective in blocking the midline defect. Implants are not very reliable so far in the deeper failure to close, but may be effective for small depth defects.

I have no experience of the Dorrance or Cronin palate lengthening procedures. The so-called Veau-Wardill-Kilner procedure was shown by Calnan to be successful in lengthening the palate to only a minor degree. Many cases will already have had this done. I am very doubtful if repeating it gives further length. Millard’s island flap, brilliant in concept, is oddly disappointing in practice. A thick plug of mucus persists on its upper surface causing chronic catarrh. It seems to make the palate too thick and reduces mobility, and it is possible that peripheral scar contracture is responsible. However, it too can be successful in correcting incompetence and can be invaluable where pharyngeal wall has already been used without success.

Pharyngeal flaps have the potential for success in about five out of six cases (in which lateral wall movement is adequate, excluding technical faults). Those attached to the trailing border (inferiorly based) or to levator
eminence (standard superiorly based) tend to reduce the amplitude of the elevation. They simply obturate the central area while the lateral walls adduct against them.

The combination lengthening operation with pharyngeal flap inserted into the nasal layer near the back of the hard palate and well forward of the levator sling does not seem to reduce the palate lift: in fact it sometimes increases it and the pharyngeal flap pedicle may then be seen to be redundant on endoscopic examination. Examples of this technique are the Hönig modification of the superiorly based flap and the Millard T flap, and if one did not have adequate facilities for pre-operative assessment, it is my present feeling that this operation more than repays the extra time of retroposing of the palate. The lateral wings of the Millard T allow essential lengthening up to the pterygoid plates.

GRABB

William Grabb, trained by Dingman at the University of Michigan and following him as chief of the unit, is not only a fine surgeon but an exceptional organizer and a prolific writer. His training and experience in cleft surgery have rendered him both knowledgeable and discerning. His 1971 book, *Cleft Lip and Palate*, with Rosenstein and Bzoch, is the best and most complete work on the subject and has been the source of much material used or referred to in *Cleft Craft*. Grabb is completely sound, with his feet firmly planted on the ground—except, that is, when he is relaxing.

Dr. Grabb’s bag is *Yankee Doodle*, his red, white and blue hot-air balloon with a unique swing seat which looks like a wheel-less wheelchair. He has served as president of the Balloon Federation of America and has been in the air more than 150 times, flying low enough above the trees to pick leaves, and flying well enough to capture third in the 1968 Indianapolis Speedway Balloon Race, third in the Columbus International Balloon Race in 1969, second in the 1970 U.S. National Championships and first at Columbus in 1970. He once flew badly enough to land in a patch of poison sumac. When asked if he wrote his books while in the air, he admitted:

No, once up, I spend most of my time figuring how to get back down!
In 1971 Grabb summarized the speech results reported in the literature during a 21-year period (1948–1968). The overall average speech of this group of 3,743 children who had operative closure of the palate cleft was normal in 71 percent of cases. Grabb also noted a definite trend of a higher rate of normal speech results in recent years, regardless of which operation was performed or who performed it.

In 1977 Grabb wrote about his University of Michigan cleft palate study designed to determine, in as objective a way as possible, which cleft palate operation or operations gave the best results. He outlined the research plan:

Beginning on January 1, 1971, some 90 children with cleft palate had the palatal cleft surgically closed by either: 1) staphylorrhaphy, 2) staphylorrhaphy and pharyngeal flap, 3) von Langenbeck palatorrhaphy, or 4) push-back palatorrhaphy with Cronin nasal mucosal flaps. The operation performed was determined in a random manner by drawing a slip of paper from an envelope. The operative technique has been carried out by a variety of staff and resident plastic surgeons following the explicit written directions and drawings in the Cleft Palate Study Syllabus.

The children with cleft palate in this study have had appropriate base line photographs, cephalograms, dental casts, and examinations recorded on the worksheet by the ear, nose, and throat physician and a plastic surgeon. These studies were repeated before each operation and will be repeated at ages 5, 10, and 15 years.

The 90 children in this study are divided into subgroups as to incomplete cleft palate, complete unilateral cleft palate, and complete bilateral cleft palate.

At the present time, the children reaching five years of age are being evaluated in regard to their speech, facial growth, and hearing. It is anticipated that at some time in the mid or late 1980's, preliminary results from this study will be reported. We do not have a computer system that will run off this data but rather it is stored in the form of dental casts, cephalograms, and worksheets in one central location. I hope the room does not catch fire.

**DICKSON**

David Ross Dickson, speech pathologist at the University of Miami School of Medicine and director at the Mailman Center for Child Development, has the ability to simplify speech nomenclature for the surgeon. He explained to us at one of our residents' conferences in 1978:
Vowels are formed by modifying the laryngeal sound in the pharynx and mouth. Low vowels may not reveal mild velopharyngeal insufficiency but high vowels will. Plosives such as $t$ and $d$ are created by stop and release with little pressure. Fricatives $s$, $z$, $zh$, $ch$, are high pressure sounds formed by back pressure forced through a restricted area causing friction and heavy impedance. When there is a constant leak, not enough pressure can be generated to produce fricatives successfully.

Dickson brings all aspects of investigation and intervention into reasonable perspective:

It seems amazing, after all these years of research, how hard it is to sort out what we know from what we do not, and what is relevant from what is not. Also, it is most interesting how much information in this area has been contributed by professionals outside the field of speech. To me, this demonstrates that cleft palate assessment and treatment is truly interdisciplinary and not just multidisciplinary, since our best information has come from professionals from a number of disciplines working together and sharing ideas and constructive criticism. It is also clear that each professional must be interdisciplinary in understanding of the problems we confront to be effective. Certainly Pigott is right that “even” speech pathologists can confuse speech attributes which are not related to velopharyngeal competence with those that are. One can be an exceptionally good speech pathologist and not understand cleft palate assessment, just as one can be an exceptionally good surgeon and not understand the problems of cleft repair.

A number of things have been brought out which I feel deserve emphasis. It should be too obvious to state at this time in our history that cleft palate is not a normal palate with a hole in it. There are physiological differences due at least in part to muscular deformities. As pointed out by Pigott, one of the most important (and most neglected) of these may be the lack of a functioning uvulus muscle. Also, there are extra-palatal morphological differences including the pharyngeal disproportion noted by Pigott and others. Work in our laboratory has demonstrated that at least in the mid-term fetus, pharyngeal and cranial base disproportions are significant in cleft palate.

The principal goals of assessment are first, to determine whether speech is adequate or inadequate; second, if speech is inadequate, whether the problem is related to velopharyngeal incompetence; and third, whether surgical intervention will be necessary. As to the first question (“Is speech adequate or inadequate?”), to date, our best instrument is a trained ear. A trained ear is one which is hooked on to an informed, experienced person capable of common sense and logical deduction. A trained ear is necessary, in part, to avoid confusion among hypernasality, hyponasality, and speech problems not causally related to current velopharyngeal dysfunction. The second
question had to do with whether an existing speech problem is related to velopharyngeal dysfunction. The assessment of velopharyngeal adequacy involves two factors: the movement patterns of the velum and pharynx, and the degree of velopharyngeal closure. The latter has been approached by Warren. Evaluation of velopharyngeal patterns of activity has been attempted by a wide variety of radiological procedures, by nasendoscopy, and by ultrasound. Use of ultrasound has not been fruitful. Nasendoscopy is difficult in young children and is often difficult to interpret due to the lost third dimension of vertical space. Radiological procedures, especially combined lateral and basal videofluoroscopy developed by Skolnick, though also difficult with very young children, seems to be the method of choice currently. However, even this procedure should be used selectively, not in grossly incompetent cases but rather in cases of marginal velopharyngeal adequacy. The bottom line in assessment is that you use the tools at your disposal efficiently. This means that if a patient walks in with a palate that is obviously extremely short and inactive and his speech is extremely hypernasal, it is not going to take a lot of fancy gadgetry to determine that he has an inadequate velopharyngeal mechanism. It’s the borderline cases that necessitate more involved evaluative procedures.

The third question was “Will speech therapy normalize speech or is surgical intervention necessary?” If velopharyngeal closure can be produced without excessive effort on occasional speech attempts, the patient is a good candidate for speech therapy, since there is at least a reasonable probability that the velopharyngeal problem is not due to structural or neurological inadequacy. If the patient does not achieve velopharyngeal closure on any speech attempt, it is unlikely that speech therapy is going to result in his being able to do so. Also, if the patient can just barely make velopharyngeal closure with maximal or concentrated effort, he will probably not be able to achieve closure with connected speech. Imagine yourself trying to use a typewriter with weights attached to your fingers. Imagine that those weights are so heavy that with all the strength you can muster, you can just barely move your fingers from one key to another. Now try high-speed typing (without any errors, of course). Another way of putting it is that you can’t expect a person who can lift a 500-pound weight to use it in his juggling act. Speech therapy may help the person who can’t get his act together but it won’t make up for a short or inactive mechanism.
FOR many years most cleft palate patients were operated on by general surgeons, dental surgeons or, if they were lucky, plastic surgeons, and that was the end of it. Merely by chance, the dentists faced the results, and occasionally a speech therapist was called in for aid. If, 23 years ago at Duke University, 65 percent of cleft palate cases had no orthodontia and 75 percent had no speech therapy, imagine what was happening in the hills of Tennessee or down in the Ozarks.

In the 30's, 40's and 50's, when St. Louis, with Barnes and Children's Hospitals of Washington University School of Medicine, was the American cleft lip and palate mecca, the surgeons totally ruled the handling of clefts. It would be somewhat chilling for me to visualize an orthodontist or a speech pathologist criticizing Barrett Brown's palate results or dictating his timing or choice of surgery. As I remember, Brown was so "busy" he could never have sat for several hours with a "team" listening to other specialists' opinion of his work. Thus, there was a one-way communication on the cleft cases, but that is not to say the aid of the dentist and the speech therapist was not sought. This is how Frank McDowell recalled those days:

When done successfully in one palate operation at 18 months, about two-thirds of these would spontaneously develop normal speech. About one-third had varying degrees of speech abnormalities—and they represented the real problem. The best solution to it was, we felt, via a careful speech analysis at about the age of 5 years by a speech pathologist who was a specialist in cleft palate speech problems. This person could then pinpoint the exact problems the child was having, prescribe the exact things the child needed to work on, then assign him to a specific teacher for individual
lessons to overcome these specific shortcomings. There were check-ups by the pathologist at about 6-month intervals to see how much progress was being made and which exercises could be dropped. This, together with skilled orthodontic care, got rid of nearly all (but not all) the speech problems. The main problem, of course, was in those children who came from a distance, who had speech problems, and who did not have these skilled personnel available to them. If it was only a couple of hundred miles, we insisted they make the trip every week.

There were also some dropouts—and one of our main functions was to try and get lackadaisical parents of children with speech problems to see how important this therapy was. Too often, for convenience, they would want to enroll them in their local school program—which was usually class therapy for stammering and made the cleft palate children worse. We had to fight this and get them to see that individual private lessons were more important than another car or another TV set.

TEAM APPROACH

In 1966 Robert H. Ivy reviewed the history of the team approach in the management of cleft lip and palate:

It is readily understood that in that period mentioned, the treatment of cleft lip and cleft palate was carried out in a very haphazard manner; almost every general surgeon had a part in it, in addition to a handful of men more or less qualified as specialists in the field.

In Pennsylvania, as time went on, certain dentists were manifesting a special interest in the dental problems involved. During these years, we began to hear more and more of Dr. Herbert K. Cooper of Lancaster, an orthodontist who had been confronted with the problem of handling many cases of unsuccessful surgery, and other cases where surgery had accomplished everything possible, but which still, to be complete, required extensive mouth rehabilitation. Some time around 1938, Dr. Cooper, in an effort to cope with some of the financial problems involved, sought and obtained the support of the Lancaster Rotary Club. Through his extraordinary talent in the professional and administrative fields, this venture culminated in the establishment of the Lancaster Cleft Palate Clinic.

At this time the secretary of health of the Commonwealth of Pennsylvania recognized that cleft lip and palate should be included in the State Crippled Children’s Program. It was also proposed that, as soon as feasible, besides surgery, the program should include general dental care, orthodontics, prosthodontia
and speech therapy. Meanwhile, at the Lancaster Clinic, the underlying philosophy of the present-day complete cleft palate management was being developed under the direction of H. K. Cooper. This was in the form of an integrated team approach by a group of clinicians representing the several interested specialties. Since those early days, *cleft palate teams* have formed in most major medical centers with better overall care for the patient. It is interesting to follow to the end the method of habilitation developed by descendants of the St. Louis dynasty. One of the important organizers in the field of cleft lip and palate is William C. Trier, who is motivated toward the team approach because of the tremendously satisfying feeling that the patient with a complex problem is having all of his needs met.

Trier, trained by Brown, Byars and McDowell in St. Louis, reminisced in 1977:

My training in plastic surgery gave me an opportunity to observe the care of children with cleft lip and palate solely by the surgeon. Although there was telephone or written communication with the orthodontist and, I presume, the speech pathologist, there was no opportunity for even these three disciplines to meet together to diagnose, plan treatment, evaluate each case.

Trier returned to the U.S. Navy and found no cleft palate team there. In five years, when he followed Joe Connelly as chief of plastic surgery at the National Navy Medical Center in Bethesda, he retained the cooperation of orthodontist Peter Cocarro of NIDR and induced Jim Lore, speech pathologist and psychologist, to form a team. Upon retirement from the Navy, he joined Erle Peacock (also trained in St. Louis), who was chief at the University of North Carolina. Trier summarized:

Among other exciting things, this gave me the opportunity to join a first-class cleft palate team. This team had begun modestly when Erle recruited a speech pathologist, rented a house in Chapel Hill with a housemother, and conducted the first Summer Resident session for seven children. The kids were entertained royally by the townspeople of Chapel Hill, got rides on the fire engine, swam in the University pool and also underwent intensive individual and group speech therapy. In the following year, Don Warren joined the faculty in the School of Dentistry and he and
Erie established a real team with the various dental specialists, pediatric and ENT support and moved the program to Story Book Farm, a camp for children on the outskirts of Chapel Hill.

There are two basic operational elements to the program. The first is a diagnostic and evaluation aspect including dental, plastic surgery, pediatrics, otolaryngology, psychology, speech pathology and social services study. The patients are presented at a weekly conference attended by all the disciplines where a summary of their findings and recommendations are presented and plan of treatment decided. I then meet with the family after the conference and outline the plan for the child.

The other major element to the program is the resident sessions held each spring and fall. The Chapel Hill school district provides a full-time school teacher who conducts an intensive academic program providing individual intensive speech treatment each week for the ten-week session. Many of the children also receive needed outpatient dental treatment during the resident session and frequently secondary surgical procedures are performed at the end of the session or even far enough in advance of the session to allow its evaluation.

**MIAMI TEAM**

Miami formed one of the relatively early cleft palate teams in 1951, when prosthodontist Cloyd Harkins came and lectured at Lindsay Hopkins Educational Center on the value of prosthetics to postpone palatal surgery. After this, the South Florida Cleft Palate team was formed and led by prosthodontist Norman Alley, including pedodontist Herman Anderson, orthodontist Robert Litowitz, pediatric surgeon Robert Dickey and, later, speech pathologist Betty Phillips. After a few years, prosthodontist George Balber became chairman and the clinics were held at Variety Children’s Hospital. In 1968, when Balber resigned, I was elected to replace him and the clinic was moved to Jackson Memorial Hospital and, eventually, to the Mailman Center for Child Development, where it meets regularly every Tuesday from 9:00 to 11:30 to evaluate, on the average, seven cases a week. Since 1968 Evelyn Shields has been our super-secretary. Many fine specialists have served on this team over the past 10 years, as seen in this photograph taken in 1978:
My early dream

As a camp counselor and later as director of my own athletic day camp, I realized the value of early training of special sports skills to young boys. By 1945, when I became interested in cleft surgery, it was my plan to create a special camp for cleft children where they could enjoy the learning of certain skills, gain the confidence such mastery brings and thus offset their apparent handicap. This camp was to have a dentist and speech pathologist, besides a cowboy, and athletes as counselors. Although I have not entirely given up the camp dream, I find that all my time and energy are being sapped in the concentrated effort to bring cleft infants to attractively functioning and appearing adults, which leaves little time or energy to teach a kid, except my own, the Texas skip, an arm roll or a right cross. I do request the cleft patients’ parents to encourage, instruct or seek instruction in special skills for their children, and under no circumstances to withhold them from any sport to which they are attracted!

In 1976 orthodontist Howard Aduss of the University of Illinois Medical Center synopsized the value of the team:

We are now seeing young adults who are the product of what has come to be known as "the team approach" to the treatment of clefts. On balance, this system has resulted in better treatment, fewer complications, and less deformity. At the same time, and most importantly, the clinician functioning within the environment of the team has not lost his individuality or freedom to innovate, but has developed new techniques based on input from this interface with other team members.

| 1. A. Goldenberg, orthod. |
| 2. C. Cabeza, audiol. |
| 3. G. Cubicciotti, vis’g p.s. |
| 4. E. Shields, sec’y |
| 5. S. Berkowitz, orthod. |
| 6. R. Litowitsch, orthod. |
| 7. A. Wolfe, p.s. (cr-fac.) |
| 8. W. Dickson, anat., sp. & b. |
| 9. J. Bensen, speech |
| 10. D. Dickson, anat., sp. & b. |
| 11. G. Sinko, speech |
| 12. F. Pullen, e.n.i. |
| 13. W. Mullin, p.s. |
| 15. Mother and patient |

Residents’ row:
16. F. Freshwater
17. R. Zaworski
18. S. Spear
19. F. Mergen

Absent:
B. Segall, prosthod.
J. Riley, speech
A. Earley, audiol.
D. Crampton, pediatr.
AN ANALYSIS OF THE TEAM

Herbert Koepp-Baker of Southern Illinois University, Carbondale, who incidentally has been a falconer for 30 years training and flying peregrine falcons, gyrfalcons, goshawks, eagles and American redtails in many parts of the world, also has had an interest in cleft palate. At the age of 10 years, on a farm in remote northern Michigan, he heard a cleft palate person speak, and after his mother explained, "Lawrence's mouth does not have a roof," he became intrigued. Years later in Pennsylvania he worked with Cloyd Harkins, experimenting in constructing and fitting prosthetic speech aids for young and old cleft palate patients. In 1978 he recalled from North Carolina:

Harkins and I taught the first formal course in prosthetic rehabilitation of cleft palate patients for a group of 25 dentists, surgeons, speech pathologists, nurses and social workers, and at the final meeting of the course the class determined to organize, becoming the Academy of Cleft Palate Prosthesis—later to become the American Cleft Palate Association. This is probably the earliest interdisciplinary effort in the field of orofacial disorders.

In 1971, in Cleft Lip and Palate, Koepp-Baker wrote on the cleft palate team. Here are highlights:

An impressive feature of congenital craniofacial deformities is the multiplexity of functional impairment which they induce. The primary goal in the treatment of children with these disorders is the reduction of the disabilities which attend them, and the alleviation of the personal and social handicap they impose. . . . The clinical team is a logical response to this need. . . . [It] makes possible a diagnosis derived from broader and more accurate sources of information, and more representative judgments and decisions. . . . [The roster of specialists] may involve: audiology, clinical psychology, plastic and reconstructive surgery, medical-social work, orthodontics (dento-facial orthopedics), otology, pediatrics, pedodontics (general dentistry for children), prosthodontics, and speech pathology. . . . There is little room for exclusive authoritarianism in clinical leadership. . . . Ennui can be the team’s most insidious disease. But it can be prevented by the early and continuing recognition that a cleft palate team can be and must be more than the conventional “medical conference.” . . . There are actually two measures which recommend themselves: research and continuing education. . . . Orderly, disciplined scientific investigation, if properly employed, can transfuse the team organism. New and stimulating ideas and
fresh, challenging information and point of view are critically essential. Properly controlled research recharges the team's flagging batteries. . . . There is also the urgent need for enlarged bases of communication in the team through continuing education . . . I am constrained to make an important concluding point . . . I have come to regard the word multidisciplinary as reflecting the quality of immaturity. The proper term describing the mature and effective team, as I conceive it, is interdisciplinary. It better suggests the attribute of interpersonal and interprofessional interaction that distinguishes this form of human enterprise.

Of course, when it is all added up, it is the surgeon in the operating room who wins or loses the game in each case. The choice of his surgery and its timing must be influenced by the facts about results seen in the orthodontist's models and the speech results as analyzed and aided by the speech pathologist and the radiologist.

**SPEECH THERAPY**

A most important aspect of postoperative palate habilitation is speech therapy. As early as 1889, Billroth had a remarkably clear understanding of cleft palate speech. As translated by Clodius, he wrote:

Dr. R. Coen lets the patients read. He reports upon the status of speech, as regards which sounds were pronounced normal and which defective, before he starts instructions. Speech therapy consisted of making the patients read loudly and especially to accent the vowels, thus training the muscles. The sounds formed in the anterior oral cavity were pronounced more easily than the ones originating from the posterior oral cavity. The voiceless sounds were more difficult to pronounce than the voiced; the plosives were less distinct than the hissing sounds. /L/ is uttered most easily, /G/ with most difficulty.

Professor Exner mentions the physiological interest of these cases, because the adults, like children, must learn to speak. As opposed to the children, however, their disadvantage consists of the fact that the adults have to forget their previous language and innervation feelings and acquire new ones.

There are several books and numerous book sections devoted specifically to the subject of speech therapy. It has been my good fortune to know three “prima ballerinas” of the speech specialty:
Muriel Morley of Newcastle, Madame Borel-Maisonny of Paris, and Betty Jane McWilliams of Pittsburgh.

Morley

Muriel Morley, speech pathologist for Wardill and later Braithwaite in Newcastle upon Tyne, England, has written a classic little book, \textit{Cleft Palate and Speech}, now in its seventh edition. Here are some of her reminiscences in 1976:

It is the nature and the prerogative of the elderly to look back over the years and perhaps to see events in a perspective which is impossible to the young and to those actively involved in creating new events.

In the middle of the 1920s, a young surgeon, William E. M. Wardill, in Newcastle upon Tyne, became interested in and concerned about the social problems facing those with abnormal, and frequently unintelligible, speech due to a cleft palate, both before and after surgery. Wardill was one of the first surgeons to give time to the follow-up of his patients and to a careful study of the speech results he was obtaining. It was at this time that we first met, and I was invited to help with the speech therapy of his patients. For the next fifteen years or so, during the 1930s and 1940s, various operative procedures were devised, aimed to produce raised scar tissue on the posterior pharyngeal wall, to narrow the pharynx and to lengthen the velum, to improve the mobility of the velum and to reduce the formation of scar tissue of the palate. Many surgeons were now operating upon children in infancy, as it was thought that if successful surgery were carried out before the child began to speak, faulty patterns of articulation would not develop. As many general surgeons continued to operate on this condition, some of the failure to the subsequent development of normal speech could be attributed to the formation of scar tissue, causing contraction and immobility of the palate and deformities of palatal growth. This led to a theory, put forward at the end of the 1940s, that early surgery could damage the growing points of the palate, and that surgery should be postponed until growth had continued to 7 or 8 years of age. The argument amongst surgeons concerning the optimum age for surgical treatment lasted well into the 1960s. However, many plastic surgeons were obtaining good results by operating in infancy and continued to do so. One of these was Fenton Braithwaite, who succeeded William Wardill in Newcastle upon Tyne.

Braithwaite, when operating on a lip, felt the essential aim was to unite the tissues as nature intended them to be and to leave growth, stimulated by muscle activity, to complete the process. He applied the same principles to the surgical repair of the palate. Braithwaite rarely used a pharyngoplasty and never as a primary procedure, as he aimed to avoid damage to the
mobility of the posterior pharyngeal wall. He used lateral incisions of the palate within the alveolar margins, which were carried posteriorly around the lateral walls of the pharynx and partially behind the posterior pharyngeal wall. This allowed the lateral walls of the pharynx and the elements of the palate to approach the midline, so that the soft palate could be sutured without any tension, thus again producing a muscle transplant of the lateral pharyngeal muscles. The optimum time for this operation was considered to be around the end of the first year of life.

Within a few days of birth, the normal reflex co-ordinations for sucking and swallowing become established. However, children begin to develop the co-ordinations for speech through vocalising and babbling, and certainly from the sixth month, these tend to become increasingly established and are necessarily abnormal in the child with a cleft palate. These faulty co-ordinations, in the control of the oral and nasopharyngeal outlets with lip and tongue movements, also tend to improve postoperatively, but if operation is postponed until speech is fully established in both its sensory and motor aspects it becomes increasingly unlikely that these patterns of articulation will change spontaneously. However, the majority of those operated upon at the optimum time (before 3 years) were observed to develop normal speech rapidly, or more gradually, without any specialised help. Continuing observation every six months showed that 97% of the children had adequate physiological control of the nasopharyngeal airway postoperatively, the majority of whom developed normal speech which persisted into later life.

Certain problems arose, however, during growth. It was necessary to watch for any hearing problems which might be sufficient to hinder speech development. There were also children in whom the interference with the normal development of the palate had occurred so early in its growth in pregnancy that there was only minimal development of palatal tissues, too limited for any operative procedure to be entirely successful at the first attempt. Some children need help in acquiring the requisite co-ordinations and control of the nasopharyngeal airway and articulation, and especially if associated with mental retardation and also when operation had been postponed until fluent speech had become fully established. There were also certain children with no palatal abnormality who have difficulty in establishing the normal phonology for intelligible and normal speech. Some such children will also be found amongst any group of children with clefts of the palate. Such children will have greater difficulty postoperatively acquiring the normal muscle movements and co-ordinations of the lips, tongue, palate and pharynx, and in developing normal articulation when the anatomical and physiological conditions are adequate.

These are my personal experiences, particularly in working from 1932 until 1963 with two eminent plastic surgeons in Newcastle upon Tyne. It
has been an interesting experience to observe the development of the treatment for this condition over a period of forty years and its gradual improvement until surgery can now achieve a functional result in most of these children.

McWilliams

Dynamic and articulate Betty Jane McWilliams, speech pathologist and director, Cleft Palate Center, University of Pittsburgh, in 1976 wrote some pertinent general observations:

1. Speech therapy is not for everyone and everyone is not for speech therapy.

2. Speech therapy is no substitute for an inadequate velopharyngeal valving mechanism.

3. It is a national disgrace that so many children with inadequate velopharyngeal valving mechanisms are being subjected to years of speech therapy that has no chance of succeeding. Steps must be taken to assure that all children with this problem get the kind of diagnostic and treatment services which they require.

4. A geographical accident appears to be responsible for determining whether children are going to have adequate management for cleft lip and palate or whether they are going to be made worse by inadequate treatment procedures.

5. The plastic surgeon is the key man on the cleft palate team because he is the only one who can restore structures to what they ought to be.

6. The speech clinician can rarely claim the credit for a cleft child who speaks normally. We are primarily diagnosticians and assessors of outcome and must rely, for the most part, upon others to provide mechanisms that will support normal speech.

7. Feeding need not be a severe problem for children with clefts, but it often is because professionals are inadequately equipped to provide instruction to parents.

8. Breast feeding need not be impossible for the child with palatal defects. It is difficult but it can be done. More attention needs to be focused on this interesting area.

Then in 1977 she discussed speech problems associated with cleft palate:

It has taken generations of surgeons and speech pathologists working together (not always in the warm harmony implied in the discussions of "team interaction" written by Pollyanna and her successors) to realize that there is no such thing as a "typical" speech pattern associated with cleft
The literature has, in fact, often rendered a disservice to children with clefts and the professionals who treat them by failing to come to terms with the beautiful reality of essentially normal speech in at least 75 percent of cleft children who are adequately treated from birth (Morris). The tragedy of this failure to state that excellent speech is the "expected" outcome, primarily from surgery alone, is that those with a success rate of zero are really not being challenged to take an honest look at their grim results. Thus, unnecessary human disasters continue to occur. We all share some of the responsibility for this—even though these events, of course, occur only in a vague place which we know as "Elsewhere, U.S.A." Why don't we simply admit that we are seeking normal speech, that we are very often successfully achieving it, and that all children with clefts are really entitled to this "equal opportunity"?

Responsibility for these remarkable advances in "cleft craft" belongs primarily to the surgeon. An information base on velopharyngeal closure has been contributed by speech pathologists, and speech pathologists have forced surgeons to new objectivity in assessing their results. However, the beautiful speech demonstrated by many children with palatal clefts is almost never the result of speech therapy per se. On the other hand, the surgeon can no longer blame his poor results on poor speech therapy and expect the speech pathologist to accept the verdict and the subsequent guilt without bringing into question the adequacy of the velopharyngeal valving mechanism and the possible role of other factors which may contribute to speech problems and to which cleft children seem to be particularly prone.

Among those factors, we consider very early in infancy the potential role of the almost universal otitis media found in children with cleft palate. Early treatment and adequate control of this condition appear to have a positive effect upon expressive language development which many studies have shown to be somewhat slow in pre-school children with clefts (McWilliams; Shames and Rubin; Smith). A part of the expressive language deficit, however, seems to be related to willingness to talk rather than to an actual disability. This has been shown with little children whose habitual sentence length was short and who usually showed less complexity than would be desirable but who could, when they were sufficiently comfortable, use the longer and more complex sentences appropriate to their life ages. Thus, while language disorders may occur in cleft children, the danger of wrong diagnosis is apparent. Nursery schools often have much to offer the average cleft child whose middle ear disease is well controlled but who needs to be stimulated to talk as well as he is able.

Another speech problem which cleft children often have is a delay in consonant articulation development. These delays are not necessarily directly related to the original deformity, but our own simplistic approaches to
problem-solving often lead us to treat the wrong thing. A seven-year-old boy is a case in point. He had no hypernasality, nasal escape, nasal turbulence, or other oral-nasal resonance imbalance. His articulation pattern, however, was immature with the substitution of w/r, f/o, and d/a. He reported that he was in "speech class" and that he was doing "bwoing exercises" because he had "a cleft palate" and had to "strenge de muscles" of his "fwoat." His articulation disorder went untreated because the clinician erroneously assumed that his speech problems must surely spring from poor velopharyngeal valving and that blowing was the best way to help him improve. The clinician thus failed to relate to the aspect of his verbal output that required modification. Little harm was probably done, but it was an expensive error in terms of money, time, and emotional investment. And the poor clinician was destined to failure, a failure sometimes unfortunately obscured by the passage of time, one of the primary modifiers of all kinds of early childhood behavior. We often look like experts because we fail to give credit to Nature's provision for maturation.

We must be aware, too, of the ever-present maxillary problems, including missing teeth and crossbites, that influence tongue behavior and may lead a child to develop a lateral lisp. This deviant channeling of air for sibilants is confusing to many listeners because they can't distinguish between the type of error and the sound that accompanies velopharyngeal inadequacy. Both arise from deviations in the air stream for speech. When this happens, sometimes pharyngeal flaps are done. The child still has his problems obviously, and the surgeon may secretly feel like a failure—as does the speech pathologist who ignores structure. The orthodontist has much to offer such patients.

Another problem of a similar nature is the anterior oronasal fistula, which, most of the time, is asymptomatic. Once in a while, it will occur in the rugae, and the patient will use the channel to produce sibilants. When he does, he will usually have massive nasal escape even though his velopharyngeal valving mechanism is just what the surgeon ordered. Closing the fistula with dental wax (or chewing gum) will often reveal that sibilants can't be produced at all without that fistula. What sounded like a posterior problem can now be understood as an anterior one, and the solution is clear. I confess that we are very much aware of this kind of problem now. Once, we were close to the door of the operating room to carry out a pharyngeal flap on a seven-year-old who thought we knew what we were talking about.

There are really hundreds of things that plague the speech pathologist. Since speech pathologists, in turn, plague the surgeons—or should—these matters are also of concern to surgeons. Hoarse voice is one of these. A ten-year-old boy with a repaired cleft on the soft palate and normal speech in spite of mild inaudible nasal escape on sibilants is such a case. When he was asked to participate in a research project, he arrived with his father,
who said immediately, "I could hardly wait to come. Just listen to his speech!" In the six months since he had last been seen, he had experienced a growth spurt, and his voice had become hoarse. Nasal escape was still present, but there was no increase in hypernasality. Videofluoroscopic examinations revealed that his borderline valving mechanism almost closed but never quite accomplished the task. He was exerting every effort to maintain the speech he had once had, and he was sacrificing his vocal cords in order to do so. Laryngoscopic examination revealed large bilateral vocal cord nodules (McWilliams et al). A pharyngeal flap was constructed, and the voice quality gradually returned to normal as the nodules diminished.

Then there are the children who really do have velopharyngeal inadequacy. If honest confession is good for the soul, then I should feel great after confessing that I don't think I have much to offer such a patient once the diagnostic work is completed. There are thousands of children and millions of dollars being invested each year in programs of speech therapy that haven't a prayer of succeeding until velopharyngeal closure—or something very close to it—becomes an anatomic and physiological possibility. Fortunately, now, the surgeon can often accomplish this with one of several techniques, usually a properly designed and executed pharyngeal flap. Sometimes, the prosthodontist must be called upon; and everybody has to settle for an appliance that will become a lifetime project for the patient. But that's better than communicative failure which will very probably persist no matter how much speech therapy is undertaken until that complicated and vital valve can work to separate the nose from the mouth.

I hope all of this has not sounded too pessimistic. However, I think it is important to face up to human limitations, and speech pathologists have them! We can contribute to the diagnostic process and see what needs to be accomplished if the patient's speech is to improve. We can help to change behavior that is not the result of insurmountable structural or motor problems. I even think we can assist the surgeon in evaluating the true nature of his results—an absolutely essential activity if we are to assure all children everywhere of the best possible speech. Fortunately, most plastic surgeons mirror these concerns, and valuable working relationships emerge and are maintained as a result.

Yules

Controversial Richard B. Yules of Worcester, Massachusetts, ever since his inspiring year with Robert Chase at Stanford University, has been interested in the postoperative speech aspect of cleft palate and has perhaps carried it a bit farther. In 1970 he wrote in *Plastic and Reconstructive Surgery*:
Speech therapy is an integral part of the team management..., but all too often the speech therapist has been the scapegoat for ego-deflated surgeons. Indication for one or the other therapy was sometimes based on who saw the patient first, rather than on a rational selection method.... Only recently have cinefluorography and respiratory data suggested that certain categories of patients may be totally correctable with speech therapy alone—while others require mechanical intervention.

Although some speech pathologists regard nasal emission generally as articulatory deviation [D. C. Spriestersbach; D. Sherman], it is possible to distinguish some articulation problems for therapy before hypernasality is eliminated. Conversely, therapy can be oriented toward elimination of hypernasality which, once achieved, makes articulation errors easier to correct. Although some comprehensive contemporary publications deny "that motor exercises are of value for increasing velopharyngeal competence," other speech pathologists find "therapeutic exercise and velopharyngeal gap" to be related. Surgical researchers have succeeded in training patients to constrict their circumpharyngeal sphincter voluntarily, getting them to condition this new-found pharyngeal aid into the speech sphere—thereby eliminating hypernasality in 60 percent of cases [R. B. Yules, J. E. Josephson, and R. A. Chase].

Such exciting speech results lead one to speculate on what effect postoperative motor training might have on postoperative results. More importantly, they add impetus to the attempts to define those variables which allow selection of those hypernasal patients who do not need surgery but who can benefit from speech therapy.

Laub

To emphasize the importance of speech therapy, Donald Laub of Stanford University wrote in 1976:

I have trained 2 people, one from Mexicali, Mexico, and one from San Pedro Sula, Honduras—both only Spanish-speaking schoolteachers—at Stanford—via totally bilingual interpreters who made tapes of the texts and the lectures and returned them to their country to follow and teach our postoperative palate patients. This has led me to the conclusion that speech therapy should be carried out on almost all patients, not just ones with "insufficient anatomy." Speech therapy, I am convinced, should have a greater role in palate habilitation and this is my present "kick" in cleft palate.
KNOW THYSELF

Richard Jobe of Stanford was presented with an 11-year-old boy who had had his secondary palate cleft closed by his general practitioner at the same time he did a tonsillectomy. As the child had wide open rhinolalia, Jobe used a superiorly based pharyngeal flap. He recalled:

The patient had an uneventful postoperative course, though since there was a slight difference in opinion in his family as to whether or not the surgery should be done, he acted out every minor agony of the surgery to the great detriment of his mother, who was in favor of the surgery, and for the pleasure of his father, who was not. The family was immediately annoyed, of course, postoperatively because the child did not have a miraculous recovery of speech to normal. I lost contact with the patient.

About two years later at a cleft palate clinic in San Jose, a speech teacher brought in the same youngster. She reported having met this child in the school speech therapy situation and had introduced him by means of tape recorder to the fact that his speech sounded abnormal. Apparently for the first time, he understood how his speech sounded to the outside world and he began, with her help, to work on making it sound right on the tape recorder. Within a couple of weeks he was able to eliminate completely the hypernasality from his speech and significantly improve his communication. Within a month of this time, the youngster would not replicate his rhinolalia for the benefit of anyone because he had learned by now to speak normally.

I cannot say with certainty that my surgery was at all necessary or beneficial to this child. Had he understood his own speech defect, he might very well have made the same conversion without the surgery. One of the most difficult chores we have is to train people who have learned to speak abnormally to understand that what sounds normal to them inside their head would sound abnormal even to them outside their head. For this reason, I insist the speech therapists use tape recorders to help in this aspect of communication."

THE IMPACT OF LEARNING

In 1977 Hughlett Morris, speech pathologist at the University of Iowa, former president of the American Cleft Palate Association and editor of the Cleft Palate Journal, noted:
Quite probably the most important contribution to the cleft palate story to be made by the speech pathologist is the crucial message that speech production patterns are influenced highly by learning factors.

In our great interest and concern to address the matter of restoring to normal—or near normal—the oral structures, we all sometimes forget that the patient learns to talk, and that how he learns to use the oral structures is at least as important (if not more so!) as the structures themselves.

An interesting example of this is the use of the so-called glottal stop, heard frequently in the speech of cleft palate patients and most clearly demonstrated in what most of us recognize as the Cockney dialect. Essentially, the glottal stop is a stop plosive consonant for which the stop phase (and build-up of air pressure) is at the level of the vocal folds, as opposed to the tongue and the alveolar ridge (the /), or between the lips (the /), and so forth.

We can't really know why a cleft palate speaker uses the glottal stop. However, we speculate that apparently he adopts that consonant as a substitution for the other stop plosives because, to his ear, the glottal stop sounds more like a normal k (or t, or p) than does a k with accompanying nasal escape of air pressure. And so in early childhood before surgery (or dental prosthesis) has been successful in providing velopharyngeal competence, many cleft palate children use the glottal stop in their speech as a substitution for other stop plosives (most likely, the k and g).

And, because that substitution has been learned, just as are other aspects of his speech and language, he may very well continue to use the glottal stop, even after velopharyngeal competence is obtained by physical management and there is no longer any "need" to do so!

Taken alone, then, the presence of glottal stops in a patient's speech is not a useful observation for diagnosis of velopharyngeal competence, because we don't know whether the glottal stops reflect a present physiologic deficit or the patient had such a deficit in the past and is still behaving as if he still has it!

When we begin treatment for such a patient, we first must determine whether the velopharyngeal mechanism is competent. If it is not, referral for consideration of further surgery is needed; if it is, speech therapy is indicated.

Jack F. Bensen joined the Speech Department of the University of Miami in 1955, the same time I came to Miami, and we have worked together ever since. He is an excellent clinical speech therapist and here are some of his thoughts:

Speech is a learned process, learned by imitation starting shortly after birth. The child imitates the sounds he hears and the usual end result is a speech
patterning similar to that used by his parents and his peers, but unique to him.

The speech pattern of the individual with a cleft palate is the result of his attempting to produce the language patterns of his environment with an inadequate mechanism. Attempts to imitate the sound patterning around him, but with less success, result in the development of compensatory adjustments, or when these are inadequate, either acceptance of distorted sound patterning or some withdrawal from speaking or any combination of the three.

Once the cleft palate child finds some method of reproducing a sound which resembles the sound being imitated, he will continue to utilize this manner of production of that particular sound and begin the establishment of a habit pattern. When compensatory adjustments become habitual, they resist change and the longer they are utilized, the more ingrained they become, increasing the difficulty of eradication.

Speech therapy requires utmost cooperation, dependent upon the intellectual maturity, attitude and motivational drive of the child and the skill of the therapist. There are four areas of concern for the speech therapist.

1. **Palatal Functioning**

If the individual has nasal emission of air during the production of all plosive and fricative sounds we have a problem. Assuming that there is adequate length and the potential for closure, it is necessary to somehow activate the function. I have found two methods effective for doing this; the more desirable is direct muscle training using a mirror. This is a very simple procedure—simply have the patient imitate your palatal action while saying "ah," reward as motion increases. When it appears that closure is obtained consistently have the patient prolong “ah” and then say “p.” If “ahp” comes out without nasal emission you are on your way. "p" is the consonant of choice because there is no tongue movement which might interfere. From “ahp” go to “ahpah” and then to the other plosive sounds. Closure for the fricatives is best obtained by starting with a plosive and transferring to the fricative, i.e., “pf” “bv” “ts” “dz” etc. The secret here is to have the patient allow a minimum amount of air to escape on the fricative element of these sounds at first, maintaining as much intra-oral pressure as possible, and gradually increase the air flow.

If the above method fails, try direct stimulation. This is done by using your finger or a tongue blade and exciting the palatal muscles by stimulation. As motion increases, have the patient feel and observe what is happening and carry on as with the mirror training.

Blowing exercises are better for young whales and dolphins.
2. *Production of Consonants*

Always begin working on the specific sound which is easiest for you to get the patient to produce. If you have a choice of two or more, start with the one that most distorts the speech. If you can get adequate production of a distorted, substituted or omitted sound by imitation, you are in clover and can go on from there. The next lucky way is to give simple directions such as "Shut your teeth and blow" for "s" or "Put your tongue behind your upper teeth and blow but don't let the air out" to get the implosion for "t," then have him drop the tongue suddenly over and over again, increasing the speed. When you have a child who consistently uses a glottal catch for the plosives, start with "p," then "b," then "t," then "d," and finally, "k" and "g," unless he can easily get one of the sounds out of this order. The "k" and "g" are the most insidious and sometimes seem to take forever. Don't despair. With a considerable amount of ear training and manipulation it will eventually come.

3. *Facial Grimaces*

The amount and speed of movement of the muscles used for nares constriction by individuals with cleft palates is truly remarkable. In their attempts to produce some semblance of normal sounding consonants, they develop an amazing ability to shut off the nasal passageway, unfortunately at the cost of facial contortions. It is wise to attack this problem as you are working on specific sound production. Don't make the mistake of trying to eliminate these grimaces all at once. Take one step at a time and use the mirror constantly, offering more encouragement the younger the person.

4. *Voice Quality*

This is the most difficult aspect to treat, as it is the most persistent of all the anomalies of cleft palate speech. Excessive nasal resonance is universal in the cleft palate population and, even after successful surgery, continues in almost all cases. Why? In the first place, we build up an aural image of self and resist any change; secondly, we have built up, through perceptive cues and kinesthetic awareness, a habitual muscle patterning subconsciously, which becomes automatic. Any change must start with an awareness of need and desire for change, and right here is where the trouble begins, because change in voice quality will make the patient sound different. Besides resisting this change, most young children lack the ability to make the finite adjustments of the mechanism required. Fortunately, this can be handled somewhat obliquely. With young children, don't attempt to work on voice quality directly. Be a bit more subtle. During drill on the faulty consonants have him open up wide but relaxed to incorporate a vowel sound. At the same time adjust the volume. When all the rest of your therapy is accomplished and this excessive nasal resonance persists, you can begin to attack.
the problem head on. Now this really becomes an art. Through imitation, suggestion (open up a bit more, make your lips round, feel the sound by your teeth, hit your hand with the sound), you must shape and manipulate and, when you get a sound that is "good," pounce on it and have him repeat and repeat, feeling and hearing what he is producing. Remember, what you are doing is training him to listen and feel perception and sensation, and this takes time.

Speech is habit and every day that an individual practices speaking with an inadequately functioning palate, he increases the development of compensatory adjustments and makes them more difficult to eradicate, justifying the speech pathologist's plea:

Surgeon,
Surgeon,
Give him a palate true
One that functions
As it's supposed to do.

We don’t want a very short one,
An immovable, tight or cleft one,
But one set back
In its right track
And we'd like it before he's two.

At the 1978 Florida Cleft Palate Association meeting, Miami speech pathologists Jan Riley and Garnet Sinko made some practical observations:

Foibles and follies of speech therapy can be attributed to three basic sources:

1. A poorly qualified speech pathologist. Minimal requirements for a speech pathologist include an earned master's degree with a major in speech pathology, and attainment of a Certificate of Clinical Competence awarded by the American Speech and Hearing Association.

2. Timing of referral is important in two respects: (a) If the child is referred in the first 12–18 months of life, over the years a qualified speech pathologist can inform the parents of the normal process of language development, refer for necessary surgical and dental services, and prevent establishment of poor speech habits by assisting with suggestions for speech and language stimulation. (b) Speech therapy at any time is limited by the amount of velopharyngeal incompetence; in the presence of complete lack of V-P closure, it is sheer folly to expect nasal emission and hypernasality to disappear or to expect the acoustic end product of articulation and resonance to be adequate. However, glottal stops and pharyngeal fricatives can be eliminated and correct tongue placement for consonants developed, thus reducing the amount of time subsequently required in therapy following surgery. It is folly to tell the child with velopharyngeal incompetence "try
harder” or “listen,” because the more physical effort the child expends, the more nasal emission will be produced. Without adequate closure the child cannot make p, b, t, d, k, q, s, z, sh, ch, or j sounds correctly, unless his nose is pinched closed. Listening for accurate production will only frustrate him and contribute to a poor self-image. It is further folly to expect a child with marginal closure, just because he can produce sounds correctly in isolated words or short phrases, to talk normally in conversational speech. In fact, this inability should be cause for referral to evaluate the need for additional surgery. The final folly is to believe that if a child has achieved velopharyngeal competence as a result of surgery, all deviant, habituated learning will have been immediately eradicated. The therapeutic process can sometimes be lengthy and is always dependent on the third source of foibles.

3. These are the environment in which the child resides and the problems of mental retardation, psychological disturbance and hearing loss, all of which compound and frequently transcend the problems associated with speaking with a cleft palate.

The most imaginative cleft lip and palate habilitation program including speech therapy has been instituted by Edward H. Kopf in Las Vegas, Nevada. To see his therapy clinic in action, which I did in 1972, is both touching and thrilling, but as it is his conception, he should tell you about it:

The Office Dummy

Ventriloquism is fun for everyone. We have used the technique with cleft palate children for seven years now as an adjunct to traditional speech therapy. Our office has been converted to the “fun office” for these children
who require repeated surgical procedures rather than a place of terror. The doctor’s smock and the nurses’ uniforms have become symbols of love and pleasure rather than fear and pain.

It has been our feeling that if a ventriloquist can communicate through a puppet with its extremely limited mouth action, no facial expression and no hands to move that person unconsciously has developed fabulous communication techniques which he can transfer to himself.

Children who have had cleft palate surgery, with or without speech problems, as well as other children with communication problems are referred to the free ventriloquism clinic in our office open for two hours every Saturday morning. Children can come if they or the family feel the need, stop when they are satisfied and return as needed when rejection or other problems occur in their lives, for love, acceptance, and learning new routines with their puppets.

The children range in age from 18 months to 15 years. They are taught ventriloquism techniques, breath control, the regular alphabet and ventriloquism substitutes, facial expressions, delivery, jokes and simple routines which are appropriate for birthday and all major holiday parties. We try to give them a skill that other children do not have so that they are the first to be invited to parties rather than the last.

The parents, especially mothers, are involved in making and repairing the puppets, writing skits, hunting jokes, home rehearsal and weekly transportation. The fathers, other siblings and grandparents make enthusiastic audiences at more formal holiday presentations. On major holidays, professional ventriloquists from the Las Vegas Strip come, listen, applaud, encourage, advise and perform one of their routines as a reward.
The children in our program learn to communicate in an exciting fun situation. They learn the alphabet early as a "head start" giving them confidence when they enter the strange world of school. They develop poise and confidence while speaking and performing before their peers, adults and strangers. They no longer fear a large crowd. They develop a sense of humor. Laughter is accepted as an expression of love rather than criticism.

When he stands up to perform with his puppet he has a dependable friend with him and he does not feel alone. The dependable friend stays with him for life. It is his puppet who has all the problems. In the beginning, it is the puppet who cannot speak well until speech becomes more polished. The excuses for the puppet's failures are marvelous. The puppet is an animal and animals don't speak well; or he is old and has no teeth; or it is a baby.
When a new "cleft palate baby" is born, the parents are invited to the ventriloquism clinic so that they can see for themselves that these children are beautiful, lovable, have normal intelligence, are clever and have pleasant personalities. They see children in all ages and all stages of repair and development. They know they have been told the truth and there are no surprises. They talk to other parents freely and can intelligently discard ridiculous folklore and old wives' tales.

Plastic surgeons do not need to learn ventriloquism to add the dimension to their offices, since there are many talented professionals and amateurs whose puppets are gathering dust in some drawer just waiting for a chance to help make a better world.

With this technique we see the development of confidence in the child, pride in the parents and love in our staff.
58. Psyche and Soul

The three volumes of Cleft Craft have been involved with the basic science, surgical principles and detailed craftsmanship developed through centuries of experience and devoted to the transformation of a patient with a cleft into the ideal normal. After all this, what about each psyche and soul?

**Individual Reaction to Deformity**

How we are going to react to a deformity, or even to life itself, may already be determined in our genes, despite the influence of specific environmental factors. As Straith and I wrote in 1951:

Let us compare two children born in different families but both with harelip and cleft palate and both approximately 18 months of age. The mother of one brought her tiny daughter in for surgical treatment at the age of 2 years. She reported that several times she had found the little girl in front of the mirror with her fingers pushing the edges of her ununited lip together in an attempt to make them stick. This child was not only aware of her deformity but she was trying to do something constructive about it. It could be predicted that as soon as adequate surgery had been completed, this child would continue to make her adjustments quite normally.

The other child was a little boy who was kept hidden in the back of the house. Upon the approach of a stranger, he would grab the bedclothes and hold them up over the cleft in his face. One glance into the frightened, pathetic eyes peeking over the bedclothes revealed that this neglected little fellow was failing in his adaptation, and mere surgical closure might not completely heal the psychic trauma already inflicted. Thus, the best chance to avoid undesirable personality changes would seem to be complete surgical correction of the deformity at the earliest date feasible.
It has been pointed out by E. Meyer that the social and intrafamilial aspects of disfigurement, the cultural milieu (abhorrence of deformity) and reactions from family and peers ("scapegoating") are at least as productive of a sense of deformity and deviancy as the individual's own reaction to his defect.

In 1978, Lynn C. Reichman of the University of Iowa noted:

Teachers rate the intellectual ability of cleft children with more noticeable facial disfigurement less accurately than cleft children with relatively normal facial appearance. Within the group of cleft children with more noticeable facial disfigurement, teachers underestimated the ability of brighter children and overestimated the ability of less bright children.

It is interesting how similar deformities can invoke such varied reaction patterns. Beethoven's pockmarked countenance probably was greatly responsible for his seeking refuge in solitude to compose a minuet rather than spending his energy at a social, dancing someone else's minuet. In contrast, George Bernard Shaw, who also allegedly had scars from smallpox, merely produced a huge growth of beard to cover them and scoffed at the world. Louis XIV decreed a new fashion in footwear to make his ungainly feet less obvious. Jimmy Durante, with the front brim of his hat turned up, seated at the piano, banging out "My Nose's Birthday," turned his head from side to side to present his huge nose in profile. Yet Cyrano de Bergerac points unhappily at his:

Tell me what hope of glory, what hope of any kind, this protuberance of mine could ever leave me.

William Shakespeare revealed an acute sensitivity to the burden of a cleft when he wrote:

So shall all the couples three
Ever true in loving be;
And the blots of Nature's hand
Shall not in their issue stand;
Never mole, harelip, nor scar,
Nor mark prodigious, such as are
Despised in Nativity.
It has been a standing assumption that physical defects can be a strong contributing factor in antisocial behavior. As I wrote with Straith in 1951:

Any deformity that a child has not noticed himself or has not been called to his attention by siblings will certainly be brought to light in school. Children are quick to observe the unusual, and with no attempt to conceal curiosity or to refrain from ridicule, they will be frank in their discussions and opinions. They tend to shun a deformed playmate, or they "dub" him with a nickname which reflects his defect. The deformed child has the mental and physical faculty for self-expression possessed by other children, but because of his deformity, he is either restrained by others or avoids the personal contacts necessary for such expression. The handicapped child, feeling inferior and alone, craves popularity. Many times these children resort to petty pilfering in order to obtain money to attract friends. One boy with facial burns, nicknamed "scarface," stole money to buy candy to give to his playmates so they would no longer be afraid to hold his hand in games.

Childhood fairy stories pose the handsome prince and the beautiful princess against the ugly witch; comic books repeat this theme with Detective Tracy against such funny-looking characters as Flat-top and B-B Eyes; movies portray western white-hat heroes against black-mustached villains. Thus, through the early years of development, there is not only the constant identification of beauty with goodness and of ugliness with evil, but there is also the attempt to identify self with the good and the beautiful. But there comes a time in the life of every deformed child, when he realizes that he cannot take the part of his ideal hero. He is reminded of this over and over by thoughtless remarks from friends and second glances from strangers. It is easy to see how a handicapped child might become delinquent and, if merely punished, driven into crime. Rear Admiral E. R. G. R. Evans of the British Navy tells the story of a boy who was taunted and ridiculed because of his ugly, protruding teeth; he was given the nickname, "Barracuda." Gradually, he turned against not only those who ridiculed him but against all society and gathered together under his command the Scarlet Fleet. He became the most feared and ruthless buccaneer on the Seas and many of those who had laughed at him as a child at school walked the plank to their death. "Thus do the cruelties of youth make rogues."

The literature is replete with characters whose antisocial behavior is determined in large part by some physical defect. Lewin
noted two examples. Victor Hugo’s Quasimodo, the hunchback of Notre Dame, is acutely aware of his own ugliness and seems to be propelled by his hatred of himself and repugnance of his own image into the protection of beauty. Shakespeare’s Richard III is a villainous character whose awareness of his physical defects presents an insurmountable obstacle to normal social intercourse as it becomes the motivating factor in his life.

In his book *This Gun for Hire*, Graham Greene’s protagonist, Raven, is a postoperative cleft lip who justifies his life of crime as a retaliation against society for its cruelties to him:

Murder didn’t mean much to Raven. It was just a new job. . . . The cold wind cut his face in the wide Continental Street. It was a good excuse for turning the collar of his coat well up above his mouth. A harelip was a serious handicap in his profession. It had been badly sewn in infancy, so that now the upper lip was twisted and scarred. When you carried about you so easy an identification, you couldn’t help becoming ruthless in your methods. It had always, from the start, been necessary for Raven to eliminate the evidence.

Plastic surgery has been used in an attempt to rehabilitate adult penitentiary inmates. The results have been equivocal. In 1966 Spira, Chizen, Gerow and Hardy indicated that 17 percent of the inmates released from a Texas prison after receiving plastic surgery were returned during a five-year follow-up period, whereas the recidivism rate among that general prison population was 31.6 percent. In 1967 Velasco, Woolf and Broadbent reported 21.3 percent and 30 percent recidivism rates in inmates receiving and not receiving plastic surgery, respectively. Yet, also in 1967, Schuring and Dodge reported no significant difference between inmates receiving plastic surgery and non-operated controls (48 percent recidivism rate for both). As early as 1948, J. F. Pick noted:

Where criminality has become an established habit . . . resistant to rehabilitation, improvement in appearance of an adult incorrigible may change the standard of his criminal practices, upon release, from that of a common thief to that of a specialist of a higher order. It is, therefore, felt that where bodily defects or gross features exist in the youthful delinquent . . . such defects should be corrected and their trigger value removed before the boy delinquent becomes the man criminal.
It was thought that plastic surgery might be more effective in the rehabilitation of deformed delinquent adolescents. Knorr, Hoopes and Edgerton in 1968 reported:

Physical changes via cosmetic surgery are more easily integrated into the body image percept by the adolescent.

In 1973 Meyer, Hoopes, Jabaley and Allen studied 21 deformed adolescent delinquents, 14 of whom had plastic surgery (one of these had a secondary cleft lip deformity); 7 were unoperated. They determined:

There were no remarkable behavioral differences between those patients who had surgery and those who did not. Surgical intervention, as an added factor, was felt to be no more effective in achieving positive change, than psychological or social intervention alone.

It was suggested:

Adolescents may already be relatively fixed in their body image concepts, so that surgical intervention is ineffective in accelerating progress.

Yet there are many encouraging examples in which surgical correction of major or minor cosmetic defects that were triggering a change of psychological reactions and leading the individual into chronic conflict with society suddenly enabled him to cope successfully with his life.

Michael L. Lewin wrote me in 1972:

My own attention was drawn to this problem years ago by a young man with an inadequately repaired bilateral cleft lip and palate who shot his friend for taunting him about his cleft palate speech. This late teen-ager was sentenced to Sing-Sing for murder. He was rehabilitated in three or four operations while in prison. He had a bone graft, revision of the lip and a pharyngeal flap. I have been in contact with him for over twenty years. He is a solid citizen, a good family man, a pillar of society.

It is important that these selected literary excerpts and comparative statistics do not mislead. Although fiction has occasionally coupled cleft lip and palate deformity with criminal personality, the fact remains that there are very few cleft individuals who have become involved in criminal activity.
SUICIDE

Medical opinion and teaching suggest that severe facial deformity renders an individual liable to depression, despondency, anger, resentment, frustration, hopelessness and possibly self-destruction. As recent statistics show, suicide is twelfth in frequency among the causes of death in the United States. Among older teenagers and young adults it ranks fourth. Numerous cleft lip and palate patients might be expected to appear in these statistics. In 1973 Jack Berger of Chicago, after having searched the literature, found a discrepancy; he reported only two cases in which a congenital cleft lip or palate could be considered a primary cause of a suicide attempt.

1. A 38-year-old male had been born with a bilateral cleft lip and palate. The lip had been repaired on two occasions with unsatisfactory results. The palate had never been operated. He lived a secluded life as a janitor, living in a small basement apartment with his mother. When his mother became seriously ill, he became threatened that he would lose her support which caused him to attempt suicide with a shotgun placed under his chin. Having chosen this method of suicide, the patient accomplished ablation of that deformed part of his body which he must have hated all his life. The present deformity, which was by no means an improvement over his previous deformity, at least could be explained as the result of an accident, not as a defect or deficiency with which he was born. Once healing was complete, he began to establish some social contacts.

2. A 19-year-old Caucasian female was born with Pierre Robin syndrome with a posterior hard and soft palate cleft and microgenia. She had closure of the velum at 3 years and was fitted with a dental prosthesis for the residual hole in the hard palate. Her speech developed slowly and poorly. Her father went to great expense to get her orthodontic and speech therapy and showed anger at her poor progress. The child, sensing rejection, developed a defense by becoming a chatterbox and the faster she talked the less intelligible she became. Her roommates “tuned her out” and forced her isolation, but she graduated from high school and entered college. Here her attempts to belong by excessive talking were unsuccessful. She was ignored by her classmates, became depressed, failed in her grades and finally attempted suicide by slashing her wrists. She was hospitalized on a psychiatric service where she began to understand what she had been doing to cause unsatisfactory relations and, with the improvement of her speech with a new aid and therapy, she re-entered college and chose a very suitable field—social service.
It is important to note that in both of these suicide attempts the corrective surgery had been inadequate and the results unsatisfactory.

In 1976 P. Arvez, J. Uriel and B. Vilar-Sancho of Madrid, Spain, studied 50 postoperative cleft lip and palate patients between the ages of 7 and 25 years, when non-adaptation and frustration are most intensely manifested. They concluded:

It is worthy of note that the axis of schizophrenia occupies a higher place both in males and females. . . . Depression appears in second place in the case of males, while for the females it occupies third place, with paranoia in second place. Also, social introversion was conspicuous in the females but not in the males.

Good aesthetic results in the males favoured a decrease of the pathological symptoms. However, this did not occur in the females.

SUCCESS STORIES

Most postoperative cleft lip and palate patients are not antisocial and have no interest in crime or suicide. They adapt to their environment and, depending on their surgical and orthodontic results, are more or less happy with themselves.

In 1972 Edward Clifford, with Eleanor Crocker and Barbara Pope, of Duke University made psychological studies of 98 cleft lip and palate patients treated surgically by Kenneth Pickrell 22 to 27 years before; 78 percent had received no speech therapy and 65 percent no orthodontia. In general, they presented relatively high self-satisfaction scores, with 77 of the group married. These findings supported L. D. Goodstein’s statement:

Informal observational impression . . . is that the typical adult with cleft palate is happily married, gainfully employed, and a generally useful, contributing member of society.

A more detailed investigation by Clifford did reveal:

Despite these relatively high overall satisfaction scores, when various items of the body-satisfaction scale were ranked according to mean satisfaction levels, the body items associated with clefts rated relatively low. For example the item with the lowest satisfaction level was teeth, closely followed by speech. Talking, nose, and lips followed in ascending order of satisfaction.
Almost none of these items appear at such relatively low levels of satisfaction in normal adolescent population.

Also in 1972, Pickrell, Clifford, Quinn and Massengill, reviewing this same group of 100 cleft patients operated on over 20 years before, found interesting scholastic achievement:

Though 15 did not go beyond the 9th grade, an additional 58 achieved a 10th to 12th grade education, and 27 went on beyond high school [8 to trade school; 2 completed 2 years of college; 1 was a C.P.A., 1 a pharmacist, 1 a registered nurse; 8 completed college; 2 completed theological seminary; 4 obtained master’s degrees in graduate school].

Edward Clifford, psychologist and co-director of the facial rehabilitation center at Duke University, admitted:

I must enjoy a psychological life as I married a psychologist.

At the Educational Foundation Symposium in 1973, Clifford explained how he responded to parents of a cleft lip and palate child when they asked whether he would grow up to be normal:

Our approach is to review with them some of the research findings with regard to the cleft palate population, that is, that they compare favorably with normal populations in terms of intellectual level, that one can find a widespread array of occupations ranging from those in the professions to unskilled laborers among cleft palate persons and that in our experience the cleft palate population is no more noted for the presence of emotional disturbance than any group. We often conclude by stating that our best guess about the baby’s future can be made by looking at his family. The motivations, ambitions, abilities and value structure of the family will probably have the greatest influence on the cleft palate child, or any child.

As noted in 1971 by Charles Wirls, psychologist for the Lancaster Cleft Palate Clinic:

In spite of compelling theoretical basis for social and psychological maladjustment in children with cleft palate, the research results have been inconclusive. If the results tend in any direction, it is toward the absences rather than the existences of maladjustments.

In 1979 Kathy Kapp of the University of Illinois at the Medical Center, Chicago, investigated the relationship of the self-concept of children with cleft lip and/or palate to the self-concept of non-cleft children. She reported:
Thirty-four cleft lip and/or palate children between the ages of 11 and 13 were individually matched with thirty-four noncleft school children. Each child was given the Piers-Harris Children's Self Concept Scale. Children with clefts, regardless of sex, reported a significantly greater dissatisfaction with physical appearance. A significant interaction effect between sex and presence or absence of cleft was found on three cluster scores with cleft girls reporting greater unhappiness and dissatisfaction, less success in school, and more anxiety. . . . It was suggested that girls may be more affected by the stigma of a physical disability because of the importance of physical attractiveness in our society.”

Among the cleft lip and palate individuals there are many who have achieved unusual success. Khoo Boo-Chai reported that the first such success story, during the Chin dynasty, involved a fourth-century Chinese lad, Wei Yang-Chi, who had his lip closed and later became the governor general of six Chinese provinces.

Blair Rogers found three more success stories. In the tenth century a seaside town in Yorkshire, Scarborough, was founded by and named as the result of an invasion by a Scandinavian, Thorgils Skarthi (“harelipped”). The eighteenth-century Thomas Robert Malthus, despite a cleft lip and speech impediment, preached as an Anglican minister until his bishop suggested he give up the priesthood. Thus, by default, Malthus turned to economics and was later appointed professor of modern history and political economy in the East India Company’s College at Haileyburg. Twentieth-century Bruce Lowery, an American writer living in Paris, was awarded the Prix Rivarol in 1961 for writing, in French, a sensitive novel entitled La Cicatrice, which tells of the problems of a young boy affected with a cleft lip scar. Here is a review of his book in English:

This is a story of a boy with a scar, the relic of a harelip. Happy at home in his parents' love and the devoted affection of a younger brother, he suffers his first great shock at school in the stupidity, cruelty, and spiteful fun-making that is so prevalent in the thoughtless world of children. Disconcerted by the wickedness which his small infirmity provokes, he himself ends by driving to despair the few beings who have shown him any affection. Driven by some troubled impulse, by an extremely complex urge, he harms the one boy whom he really loves and who has done most to protect him from the others. The remorse that follows this act is conveyed in the most moving fashion, while the boy discovers, without being able to put it into
words, that physical afflictions are as nothing beside scars on the soul. His experience, the fruit of suffering, is complete at last, when a strange and beautiful gift from beyond the grave reveals to him the meaning of love.

Lowery’s book was widely acclaimed in French literary circles, and the author, himself born with a complete unilateral cleft lip well closed by an American surgeon, subsequently translated his story into English, American vernacular, Spanish and German.

In 1976 Aarne Rintala of Helsinki, in Plastic and Reconstructive Surgery, presented the remarkable story and work of Thomas Ragawaldinpoika, the eighth child of a farmer of Tyrvää in the kingdom of Sweden–Finland, who had been born in 1774 with a unilateral cleft of the lip and palate. Although he suffered from poor health and had none of the advantages of higher education in that time, he became the most important Finnish lay psalmist of his time. Lay psalms were verses printed on loose sheets, corresponding in a way to modern newspapers. In the opening psalm of his first publication, he described himself, noting his cleft characteristics, abnormal appearance, speech difficulty and inability to suck.

In another lay psalm he described his preoperative fears and trials, the operation itself, the aftercare, and his own gratitude to Gerhardt Odenadt, surgeon of the Turku Royal Dragoon Guards regiment, and to God.

1. Work of God I sing to Thee
Who healed my Deformity,
Come with Psalms and Soul of Joy,
Pray and sing to Him on high.

2. But ah! poor thing that I am,
Nor do rightly understand,
How to do this skilfully,
Though I try most manfully.

3. For His mercy great, if aught,
Lies beyond the Power of Thought,
What in fact to me befell,
Herewithall I would fain tell.
4. For when born, in my poor Lip,
    From the first there was a slip,
    Which prevented me to talk,
    Strangely seemed my Face at fault.

5. Oftentimes for my sad Flaw,
    I did try to find a Cure,
    But it was not yet the day,
    When God's help was given to me.

6. For this thought I with me bore,
    And it was a burden sore,
    That the Pain I could not stand,
    It would leave me quite unmann'd.

7. It was also in my mind,
    When a cure I tried to find,
    That God's Will it could not be,
    Since at birth 'twas given to me.

8. Till at last God gave me strength,
    Broke the bones of fear at length,
    So that being afraid of Pain,
    Seemed no surprise again.

9. In my Conscience I found Peace,
    In my Heart a sweet Release,
    For the Preacher of the Word,
    Strengthened me to trust my Lord.

10. To a Doctor I did go,
    My Deformity to show,
    And he vowed to me he would,
    Do for me all that he could.

11. And I did myself prepare,
    Called to Jesus in my Prayer,
    That He who had suffered so,
    Might help me in my Trouble now.

12. At God's Mass, upon my knee,
    Did I make my humble Plea,
    And indeed I was assured,
    Of help coming from the Lord.

13. In the month of April sweet
    On the Sixteenth day of it,
    Did the Doctor me attend,
    My deformity to mend.

14. Put before me then a Chair,
    And I sat me gladly there;
    Held my Face and with knife-tip,
    Cut into my deformed Lip.

15. Soon I held my Eyes closed tight,
    And my Hands with all their might,
    On my Heart together pressed,
    Fingers twisted in Distress.

16. Felt a sharp and dreadful Pain,
    Felt the agony again,
    So my Flesh shivers and shakes,
    All my Body the pain takes.

17. But within with Jesus's strength
    Helpen was my Mind at length,
    So no sound from me was heard,
    Not a cry nor yet a word.

18. Though the Blood from me did pour,
    From my Veins came more and more,
    I was in a sorry plight,
    And I was a gory sight.

19. For my Shirt, my Clothes, my Breast,
    Every part of me was messed,
    With the stream of warm red Blood,
    Running down me like a Flood.

20. But the good God's mercy too,
    Helped me in my Plight anew,
    And the hardest Pain He tempered,
    His Son's suffering remembered.

21. And when my poor Gums were cut,
    Where the Doctor's knife was put,
    Then did I remember Jesus,
    With His Wounds that came to save us.

22. And when the Scissors cut away,
    Skin from flesh of lip that day,
    I remembered how He bore,
    Many a harsh blow so sore.

23. When the needles sharply pricked,
    And my lip together stitched,
    I remembered then the Spear,
    That did pierce our Lord so dear.

24. Pierced the side and through the heart
    Of our Saviour, Jesus Christ,
    In these thoughts I did attain,
    Sweet relief from all my pain.

25. Lo! See how God's mighty strength,
    Gave me comfort now at length,
    So that my Head did not swoon,
    Nor my Heart stop beating soon.

26. When I saw before me next,
    How the Blood upon my Breast
    In a kind of Jelly set,
    Then with dreadful fear I swear.

27. When the Doctor's work was ceased,
    From his task he was released,
    Then at last I oped my Eyes,
    And my hands did clean and dry.

28. Wiped the sweat off my brow,
    That from pain did start and flow,
    And my shirt too did I change,
    Cleaned the blood from every place.

29. Twas with weary toil that day,
    From my chair I went away,
    Went to lie upon my Bed,
    On my Pillow laid my head.

30. Now I was a prisoner,
    Bound up like a poor slave there,
    Not a piece of bread to eat,
    For two weeks no taste of meat.

31. The while the Doctor came to see me,
    Several times that he could see,
    How my poor lips they did look;
    At last from me the needles took.

32. The first he took upon the Tuesday,
    The second he removed on Wednesday,
    The third he took on Friday then,
    Ah! I could really feel the pain,
    For that they had rusted fast,
    To the flesh had stuck at last,
    So that I was changed in feature,
    Pale I was, a sorry creature.

33. Yea, it was a dreadful thing,
    How the needles they did sting,
    When the Doctor pulled them out;
    Then I suffered without doubt.

34. But all thanks to God I sing,
    Who created Everything;
    From the pain He me relieved,
    And from my Deformity.

35. And a good Physician gave,
    Doctor Odenadt the grave,
    Blessings to his potent Salves,
    To his Ointments and his Balms.

36. Thus the mercy of the Lord,
    To man's work he doth afford,
    Let us honour Him most high,
    Who gives help to the needy.

37. So my suffering and sorrow,
    Were relieved for the morrow,
    Jesus, of Physicians best,
    To Thee be my thanks addressed.
The success of the patient’s adjustment after the surgery is impressive, as he soon married a bride 10 years younger than himself. When this marriage was broken because of her infidelity, he married again—producing a total of nine children. Canadian John Stephenson, born with a cleft of the palate, studied medicine in Edinburgh and, after palate surgery by Roux in Paris in 1819, wrote his graduation thesis on his own operation. He then returned to Montreal, enjoying a successful career. Honorable Peter McGill gave Stephenson credit above all others for McGill College.

Other examples of postoperative cleft patients who have attained fame and fortune include renowned British surgeon Sir James Berry, innovative Newcastle anesthetist Philip Ayre, several notable American plastic surgeons and several British and American actors, including the Shakespearean actor Stacy Keach, star of television series "Caribe," who has a Blair-Mirault lip closure and was honored in 1976 with the American Cleft Palate Educational Foundation Award.

SUCCESS WITHOUT SURGERY

My favorite cleft lip story is Precious Bane, written by Mary Webb, recipient of the Femina Vie Heureuse Award for 1924–1925 for the best work of imagination in prose or verse descriptive of English life. The setting is the village of Sarn Merc in Shropshire, near the time of Waterloo. The heroine, Prudence Sarn, has an inner beauty in spite of her unoperated cleft lip deformity, but she is tortured by guilt, superstition, prejudice and constant comparison with the ideal of feminine beauty. Her sense of futility and suffering is expressed in these quotations:

"Could I help it if the hare crossed my path?"
"My poor hideous lip was, as it were, my sin, though a kind of innocent wickedness."
"... And I’d begin to dream of being as beautiful as a fairy..."
Her jealousy was understandable: "All in a minute her mouth was a rose, and I knew I couldna abide her."
A villager could be heard to say of poor Prudence: "The woman with the hare-shotten lip. A very queer creature. But it makes 'em queer, you mind, to be born the like of that. Some say she's a bit of a witch."
Of her brother Gideon Prudence had said: "Gideon could have grown what they call a moustachio and looked very well and none need have known he'd got a hare-shotten lip."

When Gideon had said to Prudence, "Being as how things are, you'll never marry, Prue," her thoughts expressed her despair: "My heart beat soft and sad. It seemed such a terrible thing never to marry."

The cost of a cleft lip surgeon for these poor farm people was a formidable obstacle, as expressed by Prue herself: "and I knew it would take a deal of money to cure a hare-shotten lip."

Yet it had been promised: "Give her money up to fifty pound, when we've sold Sarn, to cure her lip."

The hero, Kester Woodseaves, a young weaver whom Prue admired from a distance, took a stand against the brutality of bull-baiting by dogs and, in order to stop the cruelty, offered to take the dogs on one at a time. He had no trouble as they were all his friends, except a new vicious one that went for his throat. Prue saved him with a knife she had carried for his protection, and then quietly left the scene, almost unnoticed and saying to herself, "Nay, Prue Sarn, you be nought but his angel, and a poor daggly sort of angel, too."

Then followed frantic toil and thrift to bring in a corn harvest that would give security to the Sarn family and an operation for Prudence's lip. Misfortune intervened, however: the corn crop was set on fire and all was lost. The village folk turned on Prue, and had begun to stone her to death when Kester Wookseaves rode up, cleared the crowd and, as he lifted her onto his horse, said: "Come here then, Prue Woodseaves!"

Prue cried in disbelief: "But no! Kester... you mun marry a girl like a lily. See, I be hare-shotten!"

But Kester would not listen. Looking down into her eyes, he said: "No more sad talk! I've chosen my bit of Paradise. 'Tis on your breast, my dear acquaintance!" And when he'd finished those words, he bent his comely head and kissed her full upon the mouth.

**EXPORTING GOODWILL**

As the defect of any cleft of the face and mouth is a handicap, it follows that effective correction of the deformity will benefit the individual in his social setting, whether his culture be sophisticated or primitive. The goodwill engendered, like a pebble dropped into a pond, will send out ripples far beyond the original tiny splash.

My first experience in this kind of diplomatic missionary work came in Korea with the First Marine Division. Many incidents of
that time have been related through these pages. At the end of hostilities, the purpose of the marines was to rehabilitate the country, and this population was totally untouched by plastic surgery. Every anomaly and deformity imaginable was roaming about, and I went to work. This was a little unorthodox because ordinarily, when the marines were not fighting, they were just as gung ho about relaxing, and this attitude pervaded the camp. In order to do cleft surgery, it was occasionally necessary to have an anesthetist. At first he was reasonably enthusiastic. As he was not quite as infatuated by clefts as I, it became necessary sometimes to assist him, almost by the scruff of his neck, to the operating room. A recent note from Bertram Bromberg probably tells it best. He wrote:

Ralph, my brother-in-law, Irv Weinberg, was an anesthetist serving in Korea during your tour of duty there many years ago. At any rate when he returned and was relating his experiences, the first thing he wanted to know from me was if I knew a screwball plastic surgeon by the name of Millard, who operated night and day on every cleft lip in Korea. I have been subsequently delighted through the years to explain to him your contributions which were in their early stage of development at that time and have pointed out that he also, in some small way, played a role.

In my editorial in the 1962 Journal of the Florida Medical Association, missionary surgery in underdeveloped countries was suggested as an important step plastic surgeons could take toward improving international relations.

In this do-it-yourself diplomacy, the plastic surgeon can be particularly effective. Ours is a specialty which, with its hint of magic, touch of drama and more than a dab of art, is mastered by so few yet respected by so many. There is also its great humanitarian appeal. What act can bring greater rejoicing in a family and a village than the transformation of an infant with a cleft in lip, expression, palate and speech to a happy, sucking baby? The infinite influence of this specialty lies in its power to render the deformed and mutilated suitable to take their place in society and serve as living monuments not only to our specialty but to our way of life.

Jamaican program

In 1959 Kenneth McNeill and I started a Jamaican plastic surgical program. This continued with only minor interruptions until the last few years. A Jamaican surgeon, Tony Jackson, has
completed a year in our plastic surgical residency program at the University of Miami, preparing to take over a unit in Jamaica. Residents from Miami make short rotation work trips to his unit and that of Sidney Williams, continuing the two-way goodwill relationship.

An American in Taiwan

Samuel Noordhoff, trained in plastic surgery in Grand Rapids, Michigan, is superintendent of the new Foundation 1,600-bed Chang Giang Memorial Hospital, Taipei, Taiwan, Republic of China. When asked how he got to Taipei, he wrote in 1977:

In 1959, I responded to a request for a surgeon of my church, the Reformed Church in America, feeling this is what God wanted me to do. I’ve stayed here because of the people and the challenges. Having talked Ralph Blocksmia into starting a plastic surgery program, I was his first resident. I greatly appreciate his training as he was a superb teacher and surgeon with excellent concepts in lip and palate surgery. A most interesting aspect of this work has to do with abandoned babies that we’ve operated on and then have seen adopted into American homes. It’s great to get a Christmas card with the note that our little girl or boy’s the smartest one in their class. It’s unbelievable what love and proper care can do for a child, and I guess that’s what makes it fun to be a plastic surgeon.

Roth in Korea

Robert F. Roth of Salem, Virginia, studied general surgery and plastic surgery at St. Luke’s Hospital, New York, and Korean language at Yale University, after which he was commissioned a missionary of the United Methodist Church at Buck Hill Falls, Pennsylvania. From 1962 to 1972, he worked at the Wonju Union Christian Hospital in Korea, assisted Lew Jae Duk, trained by Kerwin Marcks, taught residents at the Yonsei-Severance Medical College in Seoul and, as consultant for the International Holt Adoption Program, operated on all of their cleft lip and palate cases. In 1966 he returned to the States to complete his plastic surgery training with Dick Stark and George Crikeland, and at the University of North Carolina. These are his reflections in 1977:

In the mission field, the surgeon trained and gifted in plastic and reconstructive surgery has limitless, almost luxury options for service and fulfill-
ment. One soon appreciates that all surgery in the broadest terms is "plastic." Even the purely "cosmetic" is available as a "money crop" to support reconstructive surgery for indigent patients and for non-paying projects in Public Health, the bedrock of all mission medicine. At first, the realization that for one or two million people, you are the only qualified person to perform a cheilo- or palatoplasty can be an awesome challenge. Yet even someone with a minor blemish has trouble going to school, finding a job and getting married in Korea. Someone with an un repaired or poorly repaired cleft lip or palate had best crawl into his grave as early as possible. So the answer, of course, is to close a cleft, teach one, over and over again. The sooner you make yourself dispensable, the finer your service.

While the vast majority of cleft lip patients in developed countries are corrected by three months, be prepared overseas for a patient from 6 hours to 60 years of age. Boys characteristically will be brought sooner for repair than girls. In some rural communities it is not until a girl reaches marriageable age that "it is time to repair the lip." The female palate may never have its time, since silence is considered a virtue in the Far East.

Be prepared too for some unexpected cultural factors. Multiple births are veiled in superstition as animalistic, if not cursed. Coupled with a very real handicap of no supermarket supply of milk, the new mother will give almost exclusive preference to the stronger of twins, especially a male newborn. Should one of the twins have a congenital malformation, particularly a cleft lip/palate, a cultural triage of infanticide by neglect is accepted practice. On one occasion, despite performing a cheiloplasty for a newborn twin, the emaciated, boil-studded body of the dead infant was returned to the hospital four weeks later, as if to prove it was his fate, surgery or none. A derisive, taunting, "onchungee-ya, onchungee-ya" (어 력 이 아 력 이 아, "Harelip" in Korean) is a severe condemnation for anyone with or without the anatomic blemish. Whenever possible, to pull a child out of that pit of despair is an eternal moment frequently under-appreciated in Western medicine.

Among surgeons, the plastic surgeon is tempted to sport a certain degree of hubris, since the techniques in his fingertips embody dramatic creative change. The missionary plastic surgeon is also tempted because his creative efforts are magnified by the unsophisticated eyes of nationals overseas and could lead to a delusional perception of self as the central figure in life's Sistine imagery, so familiar to us all. The temptation is there, but it is only a fool who takes a bite. To be truly effective as a missionary doctor, one must have a sense of call, a live faith and a right spirit.

Barsky Unit in Vietnam

The most famous foreign program was the National Center for Plastic and Reconstructive Surgery, which consisted of several
interconnected buildings on an acre of land in Saigon, Vietnam. This center was established by Arthur J. Barsky of New York and designated by the minister of health as the Barsky Unit. It began operation in July 1968 and continued until obliged to evacuate in April 1975. Plastic surgeons from all over the world volunteered to work and teach in this unit. During its six-year existence, 6,288 patients were admitted and another 21,842 were treated as outpatients. A total of 2,033 operations were carried out at this center: 593 cleft lip operations, 140 cleft palate and 1,300 cleft lip and palate. Speech therapy training was introduced in Vietnam for the first time.

_A Latin American program_

Project Interplast (International Plastic Surgery Program) began in 1965 and has sent plastic surgery teams into backward Latin American countries as well as transporting patients from these countries to Stanford Medical School for surgery. Educator-surgeon-scholar Donald Laub, director of Project Interplast, recalls his first case:

Nine years ago, Antonio Victoria, a fourteen year old boy from Mexicali, was brought to Stanford by the Latin American Mission Project. The child was grossly deformed by a congenital cleft lip and palate—defects that in this country would have been repaired between the ages of one and three.

Antonio's defects had made him a social outcast. His family thought they had committed a sin when they conceived him. When his deformity was corrected, he was able to return home and to lead a normal life.

_East Africa Flying Doctors Service_

Sir Archibald McIndoe, Michael Wood and Thomas Rees were in on the conception of this great program. Other plastic surgeons have served. One of them, David W. Furnas of the University of California, wrote in 1977:

My most consuming interest, outside of plastic surgery, is doing plastic surgery in developing countries where needs are great, many cases are unique challenges, the setting is romantic, and each day is an adventure. (These qualifications apply in considerable degree to Southern California, particularly if you drive any distance on the freeway). The paperwork is almost non-existent (Southern California loses!). One of the greatest joys of my life was working as a surgeon for the East Africa Flying Doctors Service in
1972–73 under Director General Michael A. Wood. It was here, under Mr. Wood's tutelage, that I saw plastic surgery in its pure form—surgery of the skin and its contents! On one's schedule one might have to repair some cleft lips, place a Küntscher nail in a femur, do a prostatectomy, take out an eight-pound ovarian cyst, repair a vesicovaginal fistula, do a cartilage graft for a collapsed leprous nose, and perhaps repair a hyena bite, a lion clawing, or a corneal tear from a thorn tree.

A high point each year now is returning to Kenya to continue this work (although I now stick to more conventional plastic surgery and leave the forays into the abdominal cavity to Mr. Wood)—nonetheless, the spectrum of pathology and challenge is always monumental.

THE EPITOME OF GOODWILL

Mammituppu is a very primitive island in the 350 San Blas island string that fringes the northern coast of Panama in the Caribbean Sea. Many of the Kuna Indians inhabiting this island were massacred by Spaniards 400 years ago, and since then they have distrusted foreigners, allowing no visitors. In 1958 missionary Roland Icke gained admittance to the island and spotted a young boy with a cleft lip. The boy, being the grandson of the chief, had been spared the usual practice of killing cleft infants by withholding food and fluids. Icke decided to use this cleft as a wedge to bring the Christian gospel to the island and invited Ralph Blocksma, who had been involved in missionary medicine since 1949 in Pakistan, to stop off on his way to Quito, Ecuador.

A visit to the island gained permission for the operation from the boy's father, but both grandfathers, who were medicine men, strongly opposed it. They said they had given the boy's mother the best possible prenatal care with their native herbs, medicine baths and chants—and in spite of this the child had been born with the deformity; therefore, nothing could be done. After much pleading by the boy's father, consent was granted. Under endotracheal anesthesia, the lip cleft was closed successfully, and as soon as the sutures had been removed the child was returned to Mammituppu. The entire village marveled at the miracle, and the patient's grandparents, the medicine men, stated that Dr. Blocksma must be a god, for certainly no man could have mended the boy in that manner. He was given the name of Rafael after the surgeon and brought six eggs as a token of his
appreciation. Thus the closure of a cleft lip finally opened the San Blas island Mammituppu to the teaching of Christian missionaries.

**Extension in Panama**

Daniel Gruver, born into a Kansas City Baptist missionary family serving in Alaska and Costa Rica, earned an A.O.A. key at Southwestern Medical School in Dallas and completed a residency at Gorgas Hospital in Panama. He then became the first doctor in the partially finished Marvel Iglesias Hospital in Ailigardi, San Blas, Panama, and for years was the only doctor and dentist for 30,000 Indians. In addition, he flies an ambulance plane, started a 100-acre farm, set up the first water supply system in San Blas, runs the town's light system, created feeding centers to prevent kwashiorkor, and gives daily devotions in the Kuna language. As he wrote in 1977:

The Kuna Indians have an extremely high rate of congenital anomalies and the highest incidence of albinism in the world. The Kuna Indians' high incidence of cleft lip, several times greater than anywhere else in the world (2% of births), causes the major part of my plastic surgery to be the closure of clefts. Although I have had no formal training in plastic surgery other than the several days in Jamaica in 1969 when I scrubbed with you, I have been able to make these babies acceptable to their families and have adopted a severe bilateral cleft which has had a preliminary adhesion. A baby born with a cleft here will be destroyed if not operated before discharge. I do not see clefts in adults. Since *Cleft Craft I*, the results of my surgery have greatly improved. I have a leave of absence during which time I hope to take one year of rotating general surgery and two years of plastic surgery in Miami.

While in training in plastic surgery in Miami in mid-1979, he told me:

In 1968 a drum of oil delivered to San Blas cost five dollars, but today costs 60 dollars. Therefore my first priority when I return is to get a windmill working to provide electrical energy for the hospital operating room, refrigerators, x-ray, lighting, centrifuge and autoclave.

**AND SO . . .**

The story told in *Cleft Craft* can be summed up in the cover boy who appears in detail on page 350 of Volume I, but whose spirit
At age 19 years he hopes to become a pilot.