PLASTIC SURGERY

VOLUME 4

CLEFT LIP & PALATE AND CRANIOFACIAL ANOMALIES

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CLEFT LIP & PALATE AND CRANIOFACIAL ANOMALIES

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Contributor

A. D. BAGNALL, L.C.S.T., M.A.A.S.H.
Speech Pathologist, South Australia Cranio-Facial Unit, Adelaide Children's Hospital, Adelaide, South Australia.

SAMUEL I. BERKOWITZ, D.D.S.
Clinical Professor of Pediatrics, University of Miami School of Medicine; Orthodontist, Dental Clinic, Miami Children's Hospital, Miami, Florida.

PETER T. BRONSKY, D.M.D., M.S.
Visiting Scientist, Department of Orthodontics and the Dental Research Center, University of North Carolina at Chapel Hill, North Carolina.

PETER J. COCCARO, D.D.S.
Formerly Associate Professor of Orthodontics, New York University School of Dentistry, and Research Professor of Clinical Surgery (Orthodontics), New York University School of Medicine, New York, New York.

ERNEST D. CRONIN, M.D.
Clinical Assistant Professor of Plastic Surgery, Baylor College of Medicine; Chief of Plastic Surgery, St. Joseph Hospital, Houston, Texas.

THOMAS D. CRONIN, M.D.
Clinical Professor of Plastic Surgery, Baylor College of Medicine; Attending Surgeon, St. Joseph Hospital, Houston, Texas.

COURT B. CUTTING, M.D.
Assistant Professor of Surgery (Plastic Surgery), New York University School of Medicine; Attending Surgeon, New York University Medical Center and Bellevue Hospital; Chief of Plastic Surgery, Manhattan Veterans Administration Hospital, New York, New York.

DAVID J. DAVID, F.R.C.S., F.R.A.C.S.
Head, South Australian Cranio-Facial Unit, Adelaide Children's Hospital; Head, Department of Plastic and Reconstructive Surgery, Royal Adelaide Hospital, Adelaide, South Australia.

DONALD H. ENLOW, PH.D.
Thomas Hill Distinguished Professor of Oral Biology, Case Western Reserve University School of Dentistry, Cleveland, Ohio.

FRED J. EPSTEIN, M.D.
Professor of Neurosurgery, New York University School of Medicine; Attending Surgeon, University Hospital, Bellevue Hospital Center, and St. Vincent's Medical Center, New York, New York.

MIROSLAV FÁRA, M.D.
Professor of Plastic Surgery, Charles University; Head, Clinic of Plastic Surgery and Burn Unit, Prague, Czechoslovakia.

MICHAEL C. FASCHING, M.D.
Minneapolis, Minnesota.

BARRY H. GRAYSON, D.D.S.
Associate Professor of Clinical Surgery (Orthodontics), New York University School of Medicine; Associate Professor of Clinical Orthodontics, New York University School of Dentistry, New York, New York.

V. MICHAEL HOGAN, M.D.
Clinical Professor of Surgery (Plastic), New York University Medical Center, New York, New York.

IAN T. JACKSON, M.B., CH.B., F.R.C.S., F.A.C.S.
Director, Institute for Craniofacial and Reconstructive Surgery, Providence Hospital, Southfield, Michigan.

MALCOLM C. JOHNSTON, D.D.S., M.Sc.D., Ph.D.
Professor of Orthodontics, School of Dentistry; Professor of Cell Biology and Anatomy, School of Medicine, University of North Carolina at Chapel Hill, North Carolina.

HENRY K. KAWAMOTO, Jr., M.D., D.D.S.
Associate Clinical Professor, UCLA Division of Plastic Surgery, Los Angeles, California.

PETER P. KAY, M.B., B.Ch., F.R.C.S.
Assistant Professor of Plastic and Reconstructive Surgery, Mayo Medical School; Consultant, Division of Plastic and Reconstructive Surgery, and Co-Director, Craniofacial Unit, Mayo Clinic, Rochester, Minnesota.

DON LaROSSA, M.D.
Associate Professor of Surgery (Plastic Surgery), University of Pennsylvania School of Medicine; Director, Cleft Palate Program, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania.

R. A. LATHAM, B.D.S., Ph.D.
Clinical Instructor in Orthodontics, University of Western Ontario; Assistant Professor of Plastic Surgery, University of Miami School of Medicine; Staff Member, Victoria Hospital Corporation, London, Ontario, Canada.

GOTTFRIED LEMPERLE, M.D.
Professor of Surgery (Plastic Surgery), Johann Wolfgang Goethe University; Chief of the Department of Plastic and Reconstructive Surgery, St. Markus Krankenhaus, Frankfurt-am-Main, Germany.

JOSEPH G. McCARTHY, M.D.
Lawrence D. Bell Professor of Plastic Surgery, New York University School of Medicine; Director, Institute of Reconstructive Plastic Surgery, New York University Medical Center; Attending Surgeon, University Hospital, Bellevue Hospital, Manhattan Eye, Ear and Throat Hospital, and Veterans Administration Hospital, New York, New York.

HAROLD McCOMB, F.R.A.C.S.
Clinical Lecturer, University of Western Australia; Plastic Surgeon, Princess Margaret Hospital for Children, Perth, Western Australia.

D. RALPH MILLARD, Jr., M.D.
Light-Millard Professor and Chief of the Division of Plastic Surgery, University of Miami School of Medicine; Attending Surgeon, Jackson Memorial Hospital, Miami Children's Hospital, and Mount Sinai Hospital, Miami, Florida.

GUILLERMO MILLICOVSKY, Ph.D.
Director of Research, International Craniofacial Institute, Humana Advanced Surgical Institutes, Dallas, Texas.

IAN R. MUNRO, M.D.
Director, Humana International Craniofacial Institute, Humana Hospital, Dallas, Texas.

G. WESLEY PRICE, M.D.
Clinical Assistant Professor of Plastic Surgery, Georgetown University School of Medicine; Clinical Instructor of Plastic Surgery, George Washington University School of Medicine; Attending Surgeon, Sibley Memorial Hospital, Washington, D.C., and Fairfax Hospital, Falls Church, Virginia.

PETER RANDALL, M.D.
Professor of Plastic Surgery, University of Pennsylvania School of Medicine; Senior Surgeon, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania.

PAMELA ROPER, M.D., Ph.D.
Attending Staff, St. Joseph Hospital, Women's Hospital of Texas, Park Plaza Hospital, and Hermann Outpatient Surgery Center, Houston, Texas.

R. BRUCE ROSS, D.D.S.
Assistant Professor, Faculty of Dentistry, University of Toronto; Director, Craniofacial Treatment and Research Centre, and Head, Division of Orthodontics, Department of Dentistry, The Hospital for Sick Children, Toronto, Ontario, Canada.

GREGORY L. RUFF, M.D.
Assistant Professor of Plastic Surgery, Duke University School of Medicine, Durham, North Carolina.

JOHN W. SIEBERT, M.D.
Assistant Professor of Surgery, New York University Medical Center; Chief of Plastic Surgery, Bellevue Hospital, New York; Director of Microsurgery, New York University Medical Center and Bellevue Hospital, New York, New York.

JAMES M. STUZIN, M.D.
Attending Surgeon, Mercy Hospital, Cedars Medical Center and Mount Sinai Medical Center, Miami; Clinical Instructor, Department of Plastic Surgery, University of Miami School of Medicine, Miami, Florida.

CHARLES H. M. THORNE, M.D.
Assistant Professor of Surgery (Plastic Surgery), New York University School of Medicine; Attending Surgeon, Manhattan Eye, Ear & Throat Hospital, University Hospital, Bellevue Hospital, and Manhattan Veterans Administration Hospital, New York, New York.

AUGUSTUS J. VALAURI, D.D.S.
Professor of Surgery (Maxillofacial Prosthetics), New York University School of Medicine; Clinical Professor of Removable Prosthodontics and Occlusion, New York University School of Dentistry; Chief of the Maxillofacial Prosthetics Service, Institute of Reconstructive Plastic Surgery, New York University Medical Center, New York, New York.

S. ANTHONY WOLFE, M.D.
Clinical Professor of Plastic and Reconstructive Surgery, University of Miami School of Medicine; Chief of Plastic Reconstructive Surgery, Miami Children's Hospital and Victoria Hospital, Miami, Florida.

DONALD WOOD-SMITH, M.D., F.R.C.S.E.
Professor of Surgery (Plastic Surgery), New York University School of Medicine; Chairman, Department of Plastic Surgery, New York Eye & Ear Infirmary; Attending Surgeon (Plastic Surgery), Bellevue Medical Center; Attending Surgeon, New York University Hospital, New York Veterans Administration Hospital, and Manhattan Eye, Ear & Throat Hospital, New York, New York.

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Introduction to Facial Clefts

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HISTORY
CLASSIFICATION
EPIDEMIOLOGY AND GENETICS

Rehabilitation of the patient with cleft lip and palate includes many of the appealing features of plastic surgery: the need to understand the etiopathogenesis or pathomechanics, being a member of a multidisciplinary diagnosis and treatment team, the opportunity for continued treatment of the patient during growth and development (the "fourth dimension"), and the execution of surgical procedures that involve the skeletal and soft tissues and demand technical finesse.

HISTORY

Each of the following chapters dealing with information to assist the plastic surgeon in the rehabilitation of the patient with facial clefting contains relevant historical information. There are excellent historical reviews of the subject of cleft lip and palate by Dorrance (1933), Rogers (1971), and Millard (1976). This introduction will be concerned only with outlining the historical trends associated with investigative studies and the treatment of facial clefts.

The Age of Empiricism

Surgeons through the ages have attempted to correct the abnormal anatomic arrangement of the cleft lip and palatal tissues and achieve a "normal" appearance. In ancient times many congenital deformities, including cleft lip and palate, were considered to be evidence of an evil spirit in the afflicted child. These children were often removed from the tribe or cultural unit and left to die in the surrounding wilderness.

Boo-Chai (1966) reported a case of successful closure of a cleft lip in approximately 390 A.D. in China, although the surgeon's name is not mentioned. In Europe many surgical techniques were used for the treatment of wounds during the early Christian era. Hot cautery was a special feature of Arabian surgery, whereas the scalpel was favored by Greek and Roman surgeons. Yperman (1295–1351) was a Flemish surgeon who appears to have written the first fully documented description of cleft lip and its surgical repair. He closed the freshened borders of the cleft lip with a triangular needle armed with a twisted wax suture, a common method of suture at the time. In order to approximate the internal and external wound edges, he reinforced the closure with a long needle passed through the lip some distance from the edges of the cleft; the needle was held in place by a wrap-around figure-of-eight thread. A similar technique of lip closure was still being performed by Pancoast in 1844.

Palatal deformities caused by syphilis and gunshot wounds interested Jacques Houllier (cited by Gurlt, 1898), who appears to have been the first to propose direct suture of

palatal perforations. However, the failure rate was high, and he suggested that when surgery failed the region could be occluded with wax or a sponge. Franco (1556) wrote: "... cleft lips are sometimes cleft without a cleft of the jaw or palate, sometimes the cleft is only slight, and at times the cleft is as long and as wide as the lip" (Rogers, 1967). In 1561 he wrote: "Those who have cleft palates are more difficult to cure: and they always speak through their nose. If the palate is only slightly cleft, and if it can be plugged with cotton, the patient will speak more clearly, or perhaps even as well as if there were no cleft: or better, a plate of silver or lead can be applied by some means and retained there" (Rogers, 1967). Palatal occlusion by plates of gold or silver was also described in 1564 by Paré, who designated such a plate as an "obturateur"; Paré (1575) was also the first to use the term "bec-de-lièvre" ("harelip").

Tagliacozzi (1597) described a lip closure that employed mattress sutures passed through all layers of the lip tissue. This was a departure from the prevailing technique of needle closure and figure-of-eight suture material reinforcement. Thus, in the sixteenth century, closure of cleft lip to improve appearance was widely practiced, and the need for closure of the cleft palate to improve speech was appreciated in more limited surgical circles.

Treatment of the protruding premaxilla using a head bandage to achieve external compression of the premaxillary segment, thereby reducing it to a more favorable position for lip closure, was introduced by Desault and Bichat (1798). Over the years, various combinations of intraoral and extraoral devices were developed in order to reduce the protruding premaxillary segment and also to maintain the lateral arch segments in adequate anatomic relationship with the lower jaw. At the present time, there is renewed interest in orthodontic (pin) appliances inserted into infants' mouths to recess the protruding premaxilla and expand the collapsed maxillary segments (see Chap. 57).

The origins of the present techniques for successful closure of the secondary cleft palate are found in the early work of Graefe and Roux, who in 1817 and 1819, respectively, closed the cleft of the *soft palate* with interrupted twine sutures. In Roux's patient, a dramatic change of voice was immediately noted and described.

Direct closure of the *hard palate* followed in 1826. Dieffenbach (1828) recommended that clefts of the hard palate could be closed by separating palatal mucosa from the bone. He also recommended lateral relaxing osteotomies to close clefts of the secondary palate, but did not employ these until 1828. This technique continued to be practiced well into the twentieth century.

Early closure of the soft palate to induce a narrowing of a wide cleft of the hard palate was mentioned in 1828 by Warren. This approach to wide clefts of the hard palate was repopularized by Schweckendiek in 1962 and is currently the subject of much debate because of associated speech problems. Langenbeck in 1859 and 1861 introduced the concept of subperiosteal dissection to elevate the periosteum with the palatal mucosa, thus forming bilateral mucoperiosteal flaps. This technique is still in use in some centers today. Veau drew attention to the fact that palatal lengthening was not achieved by this technique, and launched a full-scale attack on the technique in the Deutsche Zeitschrift für Chirurgie in 1936 (Converse, 1962). He converted Langenbeck's bipedicle flaps into single pedicle flaps based on the descending palatine vessels. Modifications of Veau's basic techniques were made by Wardill (1937), Kilner (1937), and Peet (1961), resulting in a push-back technique for closure of clefts of the secondary palate that is widely used today. Simultaneous lengthening of the nasal surface of the velum can be accomplished by the Cronin modification (1957) (see Chap. 53). Furlow (1986) advocated a double Z-plasty type of cleft palate closure.

Mirault introduced the modern crossflap technique of lip closure in 1844, and since that time nearly every conceivable type of flap—triangular, rectangular, and curvilinear—has been attempted. Mirault's technique remained popular and was advocated during the twentieth century by Blair and Brown (1930). Further modification of cleft lip closure was described in 1884 by Hagedorn, who devised a rectangular flap technique to prevent linear contracture. This procedure appears to have led to the operation of LeMesurier in 1949. During this period Z-plasty techniques were also used in various guises to relieve the tendency of linear scars to contract. This line of endeavor led to the Tennison (1952) low triangular flap technique and the high Z-plasty rotation flap of Millard

(1958) (see Chap. 52). Over the years there have been periodic advocates of correction of the nasal deformity at the time of primary lip repair. Currently, there has been a reawakening of interest in this (McComb, 1986).

Throughout the evolution of the techniques of treatment for cleft lip and palate, therapy for ancillary problems such as dentoalveolar arch deformities, nasal abnormalities, maxillary hypoplasia, and speech difficulties had also progressed to a point at which, in modern times, teams of specialists have been formed to manage the total problem, which has grown too complicated for one or two disciplines alone. This concept of the multidisciplinary team for treatment and evaluation is especially important in the case of the more complex craniofacial anomalies (McCarthy, 1976; Munro, 1981).

Management of the dentoalveolar arch deformity in the patient with cleft lip or palate by techniques of banding and prosthetic stabilization failed to achieve the goal of an adequate upper-lower dental arch relationship after early therapeutic approaches to this problem. Orthodontic therapy proceeded during the period of the eruption of the permanent teeth, and usually during the period of mixed dentition, and often, after years of treatment, a Class III malocclusion with significant crossbite remained.

This led dental innovators such as McNeil (1954) and Burston (1958) to advocate orthodontics in the first year of life in an attempt to establish proper arch relationships. These authors postulated that early alignment of arch segments would aid normal development of the maxilla. Arch position was maintained by appliances, initially a combination of internal and external appliances and finally a simple internal appliance. However, removal of the retaining appliance before puberty often resulted in recurrence of the original arch deformity. It was then thought that perhaps primary bone grafts might (1) stabilize the arch and (2) either grow or promote growth of the uninhibited maxilla. These speculations, however, had no scientific basis (see Chap. 55).

Primary bone grafting in the treatment of cleft alveolar arch deformities has lost many of its enthusiastic supporters. Initially, surgeons attempted bone grafting in the region of the incisive foramen in an effort to improve their statistics on successful palatal closure (Lexer, 1908; Drachter, 1914). Establishment of adequate bone continuity between the premaxilla and lateral bone segments appeared to some surgeons such as Axhausen (1952) to be the "final problem in the repair of complete clefts at the present time." The mere presence of the bone gap was enough to inspire a surgical rush to fill it. However, as will become apparent in Chapter 55, filling the gap was not the end of the matter. Bone grafts appear to be unable on their own to "hold apart" any arch that has a tendency to collapse; the bone graft absorbs under pressure. Also, primary bone grafts do not grow as was originally postulated, but instead hinder growth with a significant limitation of maxillary development and a dramatic increase in crossbite malocclusion and pseudoprognathism (Kling, 1964).

Moreover, as the story of primary bone grafting in cleft palate surgery unfolded, it tended to confirm the prescience of Pruzansky, who in 1964 condemned the unscientific and unsubstantiated use of primary bone grafting when bone graft fever was sweeping many surgical circles. Nevertheless, there are still some advocates of primary bone grafting (Rosenstein and associates, 1982) and most surgeons recommend bone grafting of dentoalveolar clefts at approximately the time of permanent canine eruption (see Chap. 55).

In retrospect, however, we must marvel at the ingenuity of surgeons of the past who made major progress using the trial and error method in an era when corollary scientific information was virtually nonexistent. Nevertheless, there have been surgeons throughout history who attempted to apply their knowledge of anatomy and physiology and use scientific discipline in the design of their surgical procedures.

The Scientific Approach

The nineteenth century witnessed a blossoming of scientific surgical studies in western Europe. The design of a surgical procedure came to be based on precise anatomic studies. The anatomic observations of Pancoast (1844) led him to design a specific operation, in which he divided the insertion of the palatal muscles "so as to prevent their straining the sutured edges of the palate asunder." Fergusson (1844–1845), noting that most palatal repairs disrupted, conducted a series of anatomic studies leading

him to propose an operation that divided the levator veli palatini muscles, the posterior tonsillar pillars, and sometimes the anterior tonsillar pillars. The incisions provided relaxation to the muscles and tissues of the palate in order to prevent lateral pull.

The father of modern surgery of cleft lip and palate, Victor Veau, spent many hours studying embryologic specimens. His contributions to the study of cleft lip and palate in and outside of the operating room are significant.

With regard to surgery of the cleft lip, Veau (1931, 1938) pointed out the paucity of muscle fibers in the medial aspect of the unilateral cleft and also in the prolabial segment of the bilateral cleft lip (Converse, 1962):

The median border of the cleft lip is sterile. This anatomic fact the inadequacy of the musculature of the median aspect, should provide us with a surgical directive: Demand nothing from the inner aspect which is sterile, utilize to the maximum the muscles of the lateral aspect which is fertile, sacrifice all of the mucosa of the inner aspect, but preserve carefully all of the mucosa of the lateral aspect.

The principal cause of the mediocre results obtained in bilateral cleft lip repair is the absence of muscle in the prolabial segment of the lip. One can hope for contour and shape approaching the normal only if the lip contains muscle. I have long emphasized this fact: The muscular sterility of the prolabial segment.

In the treatment of the bilateral cleft lip, Veau was one of the first to take advantage of the pressure resulting from the lip repair to recess the premaxilla:

We are operating on faces in full evolution. The profile of the face will be submitted to a dual transformation. In the nose, the vomer will grow on condition that it has not been altered and it will increase the projection of the nose. In the lip, the reconstituted muscular ring in front of the premaxilla will push it backward. The operation of the cleft lip in the newborn is not an ordinary definitive operation of the type one does in plastic surgery in the patient in whom growth is completed. Our role, in the newborn, is to create conditions of development as close to the normal as possible.

In considering surgical intervention on the vomer to recess the premaxilla, Veau wrote:

In order that the face of the newborn becomes a normal adult face, a series of unknown factors must come into play. All of these factors have their role in the distribution of forces which create the definitive form. They are the instrumental contributions the assembly of which makes the harmony we know. Eliminate the violins and you will no longer recognize a Beethoven symphony. That is what we have done (by sectioning the vomer) in the treatment of bilateral cleft lip: We have done away with the axial beam supporting the evolution of the face.

It was in embryology, however, that Veau made his greatest contribution. His career as an embryologist started when he was over 60 years of age.

I am only a surgeon, yet circumstances have led me to play the role of an embryologist. ... Yesterday, everyone said "cleft lip is caused by the absence of coalescence of the processes of the face." Tomorrow, they will say, "cleft lip is caused by the persistence of the subnarial epithelial membrane."

This concept is not my own; it is the concept of Professor A. Fleischmann, who is still living in Erlangen, where he spent his entire academic career as Professor of Zoology. I have been, however, the gardener who has been responsible for the growth of the small plant, once it was germinated. The embryologists ignored Fleischmann, or only referred to his hypothesis with irony. I showed that Fleischmann's hypothesis could be applied to all clinical varieties of the cleft lip malformation and, in addition, I have supported the hypothesis by embryological findings outlined in drawings of the stages of development of the subnarial region.

I would like to relate the set of circumstances that led me to explore an area that was not my own. Until 1930, I had never looked at an embryo. I knew of the development of the embryo only by what is found in books. I was searching for an operative method for the treatment of cleft lip and I was trying out various methods; I ascertained the fact that the only productive methods were those which approximated normal development: surgery of malformations is experimental biology. In 1926, I wrote a paper on "The role of the prolabial segment in the formation of the face." The theory of the coalescence of the processes led me to a method that I thought to be a good one because it had an embryological basis. I experienced a series of disasters. I was deeply distressed. What was wrong? Was it the surgical technique that was not successful or was embryology providing the wrong directives? I did not understand that I should look at the embryo as a surgeon instead of searching for new ideas in surgical techniques. I was encouraged to go to Vienna to see Professor Fischel who had the famous collection of embryos. There I heard the name of Professor Fleischmann and I began to have some precise idea of the evolution of the face.

The ideas of Fleischmann tallied with what I know of the various types of the cleft lip malfor-

mation; but I had difficulty in understanding the work of the German author; his pictures were poorly demonstrative. I wrote to him asking for explanations. Since that time, we have not ceased to be in touch with each other. We have written volumes of letters to each other.

In 1935, I wrote a paper entitled: "Hypothesis of the initial malformation of the cleft lip." I did not try to do the work of an embryologist. Staying on clinical grounds, I showed that the theory of the facial processes fitted poorly with what I observed in the cleft lip; the theory of Fleischmann, on the other hand, appeared to be the key to all the anatomical details and clinical varieties of the deformity. This was an indirect attack on the classical theory. Fleischmann had sent me diagrams drawn from cat embryos for this paper. These drawings were necessary, I felt, to provide a visual explanation of the theory of the professor from Erlangen.

I sent this paper to Professor Hochstetter, whom I did not know. I admired his work: he had been the first to describe the oronasal membrane, which is an incomprehensible finding according to the theory of the facial processes. Hochstetter did not go as far as to denounce the theory of the facial processes, but his own research, in addition to what I had observed in Fischel's laboratory, convinced me that the facial process theory was a "myth" that has vitiated the study of embryology of the face.

Hochstetter answered my letter, "I have had two specimens of cleft lip embryos put away in a drawer for many years, I have never discussed these specimens because I do not understand them. I am sending them to you." You can imagine how joyful, but at the same time, how anxious, I was when I looked at these specimens. There I found the indisputable proof of the Fleischmann theory. These specimens were embryos of 22 mm (unilateral cleft) and 23.3 mm (bilateral cleft).

I then returned to Vienna. With Hochstetter, I discussed the embryos at great length and in great detail. In Fischel's laboratory, I worked with his first assistant, Professor Politzer. We wrote a paper entitled: "The primary palate. Formation. Anomalies." This is a work of pure embryology: we studied 140 embryos from 5 to 25 mm in size at which the definitive form of the face is constituted.

While I was working on this paper (April, 1935), I went to Heidelberg to operate on cleft palate patients in the service of Professor Kirschner. I visited the embryological laboratory of Professor Keibel, who had just recently died. I arrived when they were finishing the staining of a specimen of a 22 mm embryo with a cleft. It showed renewed proof of Fleischmann's theory. Professor Hoepke, the first assistant, to whom I explained my idea, was not convinced.

Embryologically, the oronasal membrane which plays a role in the cleft lip is constituted by two fundamentally different formations: (A) The floor of the nose between the integument and the nasopalatine canal. This region is formed by the primary palate, a very precocious embryonic structure (5 mm, 2nd week) which appears when the mesoderm has invaded the epithelial wall (7 mm) and is definitively constituted when bone has commenced to differentiate into the undifferentiated mesenchyme (11 mm, 5th week). (B) The hard and soft palate. This long partition is constituted by the secondary palate, a relatively late embryonic formation, definitively constituted when the palatine processes have achieved their fusion (30 mm, 12th week). The malformation in the secondary palate is the congenital cleft of the palate. Most often (6 out of 10) the malformation of the primary palate, the true cleft lip, is associated with a malformation of the secondary palate and the two deformities form a teratologic entity which is dissociable because of its embryonic origins, but which forms, nevertheless, a clinical and surgical entity.

The gist of Fleischmann's hypothesis consists in the following: The cleft palate is the arrest of the disappearance of the epithelial membrane which remains intact, not penetrated by the adjacent mesoderm. Figure [45–1] is the diagram which Politzer and I arrived at in 1936. It summarizes the formation of the subnarial region. The legends explain the 5 stages. We used 108 drawings of normal embryos to represent these stages. We made an effort to eliminate the role of our imagination. We avoided making any comments on our illustrations for fear that these comments might be prejudiced. We did not allow ourselves to define the process of evolution ... In our paper the word "process" does not appear.

The work of Veau has been quoted at length in order to demonstrate his awareness of other scientific disciplines and his dedication to scientific objectivity. He employed information from outside his own narrow field. His style and approach can be an inspiration to those who continue to manifest an interest in cleft lip and palate.

Fára's study of the anatomy of cleft lip and palate (1968); Kriens' (1969) research on the anatomy of the cleft palate and velopharyngeal region; the investigation by Lubker of the physiology of the velopharyngeal mechanism (1968); the work of Warren and Devereux on the aerodynamics of the velopharyngeal region (1966); the acoustical analysis of speech and velopharyngeal incompetence by Isshiki, Honjow, and Morimoto (1968); the embryologic studies of Avery (1962); the anatomic studies of Stenström and Öberg (1960) on cleft lip-nose deformity; the analysis of the anatomy of the columella by Latham (1970); and Johnston's studies of the etiopathogenesis of clefting (see Chap. 48) provide the kind

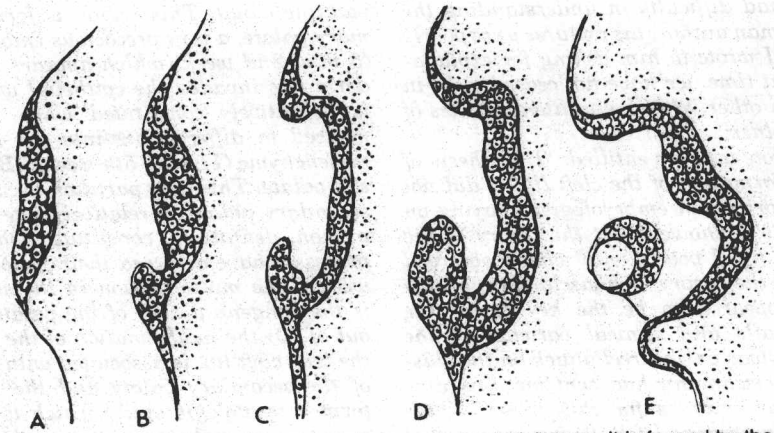

Figure 45–1. Formation of the primary palate. *A,* The plaque is the initial stage. It is formed by the localized thickening of the ectodermal covering (5 mm embryo). *B,* The fossa is produced by the raising of the edges of the plaque and the formation of a spur on the caudal aspect. *C,* The epithelial wall is the result of the increase in height of the spur by the drawing together of the edges of the fossa. *D,* The disappearance of the wall coincides with the spread of the mesoderm. It is not possible to say whether the primary role is played by the ectoderm, which becomes hollow, or by the mesoderm, which perforates it. *E,* The primary palate is formed by the extension of the mesoderm, whose progressive growth leads to the formation of the subnarial region (16 mm embryo). (Redrawn after Veau, V., and Politzer, J.: Le palais primaire. Formation. Anomalies. Ann. Anat. Pathol., *13*:275, 1936.)

of information that must be sought if the surgeon is to continue the strong heritage of the past in seeking the final goal: to make the abnormal as normal as possible.

Contemporary Theories

Throughout the historical development of the treatment of cleft lip and cleft palate, different aspects of the problem have alternately received priority. At the time of publication of this book, there appears to be an emphasis on the role of nasal correction at the time of primary lip repair, a revival of a procedure attributed to Blair (Holdsworth, 1951). This surgical concept had been earlier criticized as interfering with subsequent nasal development, but present advocates (McComb, 1986) have emphasized that, properly executed, primary nasal surgery restores nasal form without having a deleterious effect on normal development (see Chap. 53).

A second area of contemporary interest concerns the use of orthodontic appliances in infants for repositioning of the dentoalveolar segments in order to achieve a gingival repair as well as an optimal, tension-free lip repair (see Chaps. 53 and 57).

Another area of interest for the surgeon today is the problem of crossbite and malocclusion resulting from cleft palate repair. Combined orthodontic-orthognathic surgical programs are discussed in Chapter 29.

Treatment of the anterior palatal deformity has been modified after the publication by Walker and associates (1966) of data indicating the deleterious effect of extensive lateral undermining to facilitate the lip repair. The authors suggested that the technique of lip adhesion, followed in several months by lip closure without lateral periosteal or soft tissue undermining, significantly reduces the incidence of crossbite and malocclusion.

In addition, early complete closure of the primary and secondary palates can also produce significant dental deformities. Ross and Johnston (1972) suggested that surgery should not be performed on the hard palate in areas adjacent to or abutting on teeth during the years of growth and development. An alternative approach is the Schweckendiek (1962) technique of simple closure of the soft palate, followed by obturation of the hard palate cleft and delay of repair of the latter until age addresses this problem. However, longitudinal studies (Cosman and Falk, 1980) demonstrated significantly impaired speech when this therapeutic program is followed.

CLASSIFICATION

Various classification systems have been proposed, but only a few have found wide clinical acceptance.

In the classification of Davis and Ritchie (1922), congenital clefts were divided into

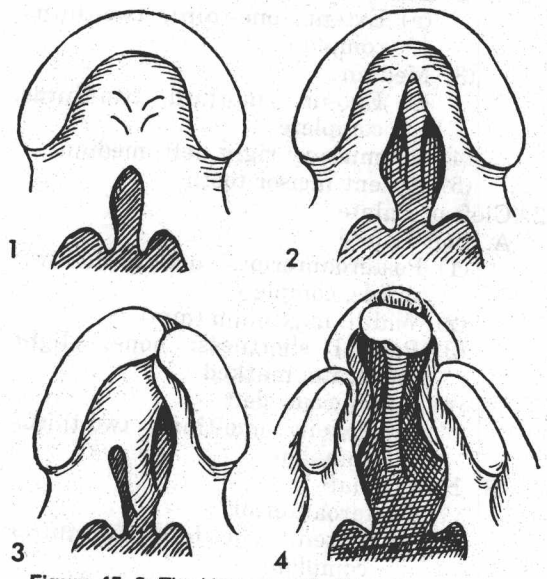

Figure 45–2. The Veau classification of the clefts of the lip and palate. Group 1: cleft of the soft palate only. Group 2: cleft of the soft and hard palate as far forward as the incisive foramen. Group 3: complete unilateral alveolar cleft, usually involving the lip. Group 4: complete bilateral alveolar cleft, usually associated with bilateral clefts of the lip. (After Veau, 1931.)

three groups according to the position of the cleft in relation to the alveolar process:

Group I: Prealveolar clefts, unilateral, median, or bilateral.

Group II: Postalveolar clefts involving the soft palate only, the soft and hard palates, or a submucous cleft.

Group III: Alveolar clefts, unilateral, bilateral, or median.

Veau (1931) suggested a classification divided into four groups (Fig. 45–2):

Group 1: Cleft of the soft palate only.

Group 2: Cleft of the hard and soft palate extending no further than the incisive foramen, thus involving the secondary palate alone.

Group 3: Complete unilateral cleft, extending from the uvula to the incisive foramen in the midline, then deviating to one side and usually extending through the alveolus at the position of the future lateral incisor tooth.

Group 4: Complete bilateral cleft, resembling Group 3 with two clefts extending forward from the incisive foramen through the alveolus. When both clefts involve the alveolus, the small anterior element of the palate, commonly referred to as the premaxilla, remains suspended from the nasal septum.

Kernahan and Stark (1958) recognized the need for a classification based on embryology rather than morphology. The roof of the mouth—from the incisive foramen or its vestige, the incisive papilla, to the uvula—is termed the secondary palate. It is formed after the primary palate (premaxilla, anterior septum, and lip). The incisive foramen is the dividing line between the primary and secondary palates (Fig. 45–3).

A cleft of the secondary palate is further classified as incomplete or complete, depending on its extent. An incomplete cleft is the common cleft of the velum, while a complete cleft includes both the velum and the hard palate as far as the incisive foramen. To this classification must be added the cleft of the mesoderm of the palate, or submucous cleft, which may be camouflaged unless the uvula is cleft. It may not be easy to detect dehiscence of the velum musculature, but the presence of velopharyngeal incompetence and palpation of a notching of the posterior nasal spine aid in the diagnosis.

Kernahan (1971) subsequently proposed a

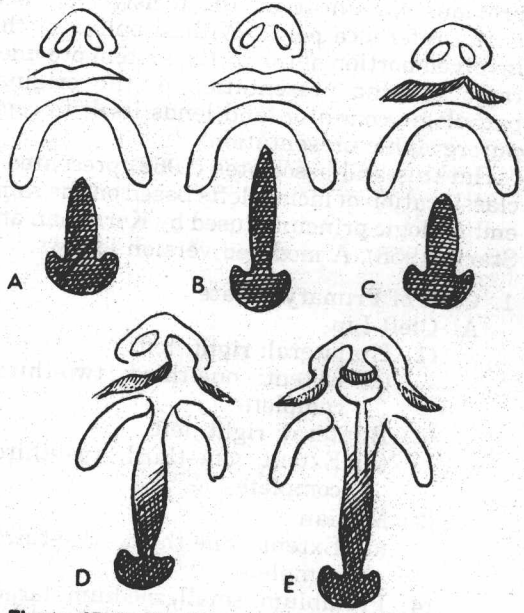

Figure 45–3. Classification of cleft palate. The division between primary palate (prolabium, premaxilla, and anterior septum) and secondary palate is the incisive foramen. *A*, Incomplete cleft of the secondary palate. *B*, Complete cleft of the secondary palate (extending as far as the incisive foramen). *C*, Incomplete cleft of the primary and secondary palates. *D*, Unilateral complete cleft of the primary and secondary palates. *E*, Bilateral complete cleft of the primary and secondary palates. (After Kernahan and Stark, 1958.)

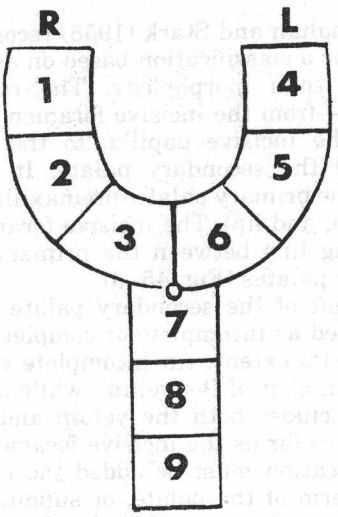

Figure 45–4. The striped Y classification. The involved area is filled in by pen and provides graphic demonstration of the site and extent of cleft involvement. (From Kernahan, D. A.: The striped Y–A symbolic classification for cleft lip and palate. Plast. Reconstr. Surg., 47:469, 1971.)

striped Y classification (Fig. 45–4). As in the previous classification, the incisive foramen is the reference point. With stippling of the involved portion of the Y, the system provides rapid graphic presentation of the original pathologic condition and lends itself to computergraphic presentation.

Harkins and associates (1962) presented a classification of facial clefts based on the same embryologic principles used by Kernahan and Stark (1958). A modified version follows:

1. Cleft of Primary Palate
   - A. Cleft Lip
     - (1) Unilateral: right, left
       - (a) Extent: one-third, two-thirds, complete
     - (2) Bilateral: right, left
       - (a) Extent: one-third, two-thirds, complete
     - (3) Median
       - (a) Extent: one-third, two-thirds, complete
     - (4) Prolabium: small, medium, large
     - (5) Congenital scar: right, left, median
       - (a) Extent: one-third, two-thirds, complete
   - B. Cleft of Alveolar Process
     - (1) Unilateral: right, left
       - (a) Extent: one-third, two-thirds, complete
     - (2) Bilateral: right, left
       - (a) Extent: one-third, two-thirds, complete
     - (3) Median
       - (a) Extent: one-third, two-thirds, complete
     - (4) Submucous: right, left, median
     - (5) Absent incisor tooth
2. Cleft of Palate
   - A. Soft Palate
     - (1) Posteroanterior: one-third, two-thirds, complete
     - (2) Width: maximum (mm)
     - (3) Palatal shortness: none, slight, moderate, marked
     - (4) Submucous cleft
       - (a) Extent: one-third, two-thirds, complete
   - B. Hard Palate
     - (1) Posteroanterior
       - (a) Extent: one-third, two-thirds, complete
     - (2) Width: maximum (mm)
     - (3) Vomer attachment: right, left, absent
     - (4) Submucous cleft
       - (a) Extent: one-third, two-thirds, complete
3. Mandibular Process Clefts
   - A. Lip
     - (a) Extent: one-third, two-thirds, complete
   - B. Mandible
     - (a) Extent: one-third, two-thirds, complete
   - C. Lip Pits: Congenital lip sinuses
4. Naso-ocular: Extending from the narial region toward the medial canthal region.
5. Oro-ocular: Extending from the angle of the mouth toward the palpebral fissure.
6. Oro-aural: Extending from the angle of the mouth.

Spina (1974) modified and simplified the above classification as follows:

Group I: Preincisive foramen clefts (clefts lying anterior to the incisive foramen). Clefts of the lip with or without an alveolar cleft.

- A. Unilateral
  - (1) right { total when they reach the alveolar arcade or partial
- B. Bilateral
  - (1) total
  - (2) partial { on one or both sides
- C. Median
  - (1) total
  - (2) partial