Knowing something of the anatomy of clefts is an important first step in understanding and communicating with the specialists on your child’s treatment team. Understanding all the variations that can exist in cleft anatomy will make the treatment picture come together better and will make you less uncomfortable about the surgical and orthodontic treatment procedures that your child will undergo. While the anatomy of clefting is not really complicated, the terms will probably be unfamiliar to you. Take some time to learn the terms and concepts presented in this chapter, and refer to the glossary at the end of the book (page 201) when you need to.

The Normal Palate

The roof of the mouth is also the floor of the nose. It is made up of a bony (hard) section, which is composed of two parts. The primary palate, or premaxilla, is the front part carrying the four upper front teeth (also called the central and lateral incisors).
The dashes outline the portion of the lip and the palate that develops separately from the hard and soft palate. *Unilateral clefts* of the lip occur on one side or the other along the dotted line through the lip and possibly the palate. *Bilateral clefts* of the lip occur on both sides of the incisive foramen and include the lip segment called the *prolabium* (the part of the lip attached to the premaxilla). (Adapted from Millard, Ralph D., Jr. *Cleft Craft*. Boston: Little, Brown, 1977.)
The **secondary palate** is the bony area behind the primary palate containing the rest of the upper teeth. These bones on the right and left are also called *lateral palatal segments*. These bones normally fuse together in the middle during the first nine weeks of fetal development.

The soft palate (as distinguished from the hard or bony palate) and uvula are muscles attached to the rear of the hard palate, and during speech they act together as a valve separating the mouth (oral chamber) from the nose (nasal chamber). The uvula, which can be seen dangling at the back of the throat, is a small muscle at the back end of the soft palate. Together, the soft palate and uvula control air flow and prevent food from entering the back of the nose.

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**The Face and Palate with a Cleft**

Clefts of the lip and palate involve primarily muscular and bony parts of the face, mouth, and throat. A cleft of the lip and/or palate occurs when the lip elements and the right and left palatal segments fail to come together within the first nine weeks of a fetus’s development.

It is important to distinguish between complete and incomplete clefts of the lip and palate because the extent and location of the lip and palatal cleft determine the degree of facial distortion seen at birth. *Incomplete* clefts of the lip have intact skin and muscle between the lip and the nose. This band means less distortion brought on by abnormal muscle pull. In *complete* clefts of the lip, the cleft extends through the entire length of lip to the floor of the nose. The abnormal muscle pull distorts the nose extensively and creates wide clefts between the lip
segments. In complete clefts of the lip and palate, the lip and palatal segments are pulled in abnormal
directions by the separated muscles, causing the lip
and nose to appear to be broader and flatter than
they would be in incomplete clefts.

When complete clefts of the lip involve the hard
and soft palate as well, wide separation of the right
and left lateral palatal segments occurs because of
an absence of an attachment of the palatal segments
with the vomer (the partition that separates the
nasal chamber into two parts). The protruding pre-
maxilla in complete unilateral and bilateral (one-
and two-sided) clefts of the lip and palate is carried
forward in the facial profile by an overgrowth of
the bone attaching the premaxilla to the nasal sep-
tum. The premaxilla in incomplete bilateral clefts of
the lip does not extend as far forward in the facial
profile as it does in complete bilateral clefts. All of
these problems can be corrected with surgery, time,
and subsequent growth, which is essential to the
corrective process.
Variations in clefts

As children differ because of their variable and individual endowments, so may their clefts show differences. Normal growth adds yet another dimension to the malformation, because it alters the cleft and its associated parts, either simplifying or complicating treatment.

There is great anatomic variation in the types of clefts. The anatomic classification system for clefts is based on the location, completeness, and extent of the cleft. Since the lip, alveolus (tooth-bearing area), and the hard palate develop from different embryonic sources, any combination of clefting can exist. Clefts of the hard and soft palate alone (isolated cleft palate) may vary in shape and length, extending in various degrees to the area just behind and between the two central incisors.

At birth, the cleft palate, nostril, and the nasal chamber are distorted by the outward pull of the muscles of the lips and cheek around the cleft. Should the hard palate be cleft, the tongue will enter the cleft and push the palatal segments apart as well. As a result, the width of the nasal chamber on the cleft side will increase.

The noncleft palatal segments may be attached to the vomer (the part that separates the nasal chamber into right and left halves) and, therefore, be in a relatively normal position. Alternatively, the cleft segment is detached from the vomer and is pulled outward by abnormal muscle pull of the surrounding cheek and lip muscles.

Uniting the lip musculature in complete clefts of the lip and palate will reduce nostril and palatal distortion by causing the lip, nose, and palatal segments to move together into a more normal relationship.

The degree of initial palatal displacement seen at birth is not related to the ability to bring the palatal segments into ideal alignment; that is, the widest
Clefts at birth with highly separated palatal segments can still be brought into good alignment by surgically uniting the cleft lip, and by using extraoral (outside the mouth) elastic forces or an intraoral (inside the mouth) plastic plate.

Incomplete unilateral cleft lip.

Incomplete bilateral cleft lip.

Complete unilateral cleft lip.

Complete bilateral cleft lip.
Shown are the variations in the main types of clefts. Top row, primary palatal clefts. Far left, normal lip. The clefts may involve the lip only or may include the alveolus (tooth-bearing area) as well. The cleft can extend toward the nostril on one or both sides. Middle row, the cleft of the alveolus can extend to the incisal papilla on one or both sides to any degree (roof-of-the-mouth views with top as the front of the mouth and bottom as the back of the mouth). Bottom row, secondary palatal clefts. From left to right, no cleft of the uvula; cleft of the uvula with a submucous cleft of the hard palate (outlined with dots); cleft of the soft palate and uvula; isolated cleft palate (two shown). The cleft involves the soft and hard palate up to the incisal papilla to various degrees.
Combined palatal clefts, roof-of-the-mouth views with top as the *front* of the mouth and bottom as *back* of the mouth. In both unilateral (one-sided) and bilateral (two-sided) clefts of the lip and palate, various palatal relationships can exist depending on the completeness of the cleft. Note that when a complete bilateral cleft alveolus exists, the premaxilla projects forward. Ultimately the premaxilla will be repositioned within the arch by orthodontics.
Submucous cleft palate. This cleft is characterized by a bifid uvula, lack of muscle continuity across the soft palate, and a pink zone of mucosa (zona pellucida) across the cleft in the hard palate. A palpable notch in the posterior of the hard palate is always indicative of the presence of a cleft.

This anomaly is seldom apparent at birth, and the first awareness of the defect occurs when the child develops the hypernasality characteristic of uncorrected cleft palate speech.
Isolated Cleft Palate

The cleft involves the soft palate (velum) and can extend into the hard palate to any extent.

The numbers represent the ages the casts were taken - years - months - days.

Note: In many clefts the cleft space can narrow with age (growth) making surgical closure of the cleft space easier.
**Variations in Cleft Types**

Variations in complete clefts of the lip and palate: effects of abnormal muscle forces on palatal form. The united tubicularis oris (lip) -buccinator (cheek) superior constrictor muscle ring contains the developing palatal (roof of mouth) segments. If the muscle ring is broken, the resultant forces pull the skeletal segments outwardly.

A. Complete bilateral cleft lip and palate. The abnormal muscle forces have pulled the lateral palatal segments laterally, and the tongue pushes them apart from within. The projecting premaxilla is laterally flexed at the premaxillary-vomerine suture.

B. Complete unilateral cleft lip and palate. The aberrant muscle forces have pulled the lateral palatal segments laterally, and the tongue pushes them apart.

C. Cleft of the lip and alveolus. The premaxillary portion of the larger palatal segment has been pulled outward as a result of the separated lip muscles. (Courtesy of J. D. Subtelny)