



BONE GRAFT SURGERY



ACPA Family Services
Resources for your cleft journey

BONE GRAFT SURGERY

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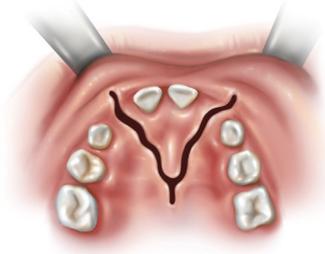
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WHAT IS AN ALVEOLAR CLEFT?

Sometimes, a child born with a cleft lip also has a cleft in the gum line. Instead of having a smooth upper gum line, there is a gap just above the teeth. The bone under the gum line is called the *alveolar ridge*. The gap is called an *alveolar cleft*. An alveolar cleft originates near the teeth and can extend all the way up to the nose. Just like a cleft lip, an alveolar cleft can happen on one side of the mouth or on both sides.

An alveolar cleft needs to be closed. *Bone graft surgery*, also called *alveolar cleft repair*, closes the spaces in the bones beneath the gums. It also closes the spaces in the gums themselves.



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Figure 1: Bilateral alveolar cleft



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Figure 2: Before bone graft surgery



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Figure 3: After bone graft surgery

WHAT ARE THE GOALS FOR BONE GRAFT SURGERY?

In order for adult teeth to grow in properly, they need to be anchored in bone. Bone graft surgery creates a stable *maxilla* (upper jaw), which gives the teeth a place to grow. Without a strong upper jaw, several things could happen. The adult *incisor* and *canine* teeth could fall out. The healthy teeth around the cleft area could become crowded and crooked. The gums could get irritated. Later on, braces may not be effective.

In addition to stabilizing the upper jaw, bone graft surgery also closes the hole in the gum line. While a surgeon closes most of the opening between the mouth and the nose during cleft palate repair surgery (usually performed during a baby's first year), a child may still have a cleft in the gum line. Closing the alveolar cleft will stop liquids, like drinks or some foods, from leaking through the cleft in the gum line and coming out of the nose. It will also prevent food from getting caught in that space and will block air from escaping during speech. Bone graft surgery also increases bone support to the nose, which can make the nose look more symmetrical.

HOW DO WE KNOW IF A CHILD NEEDS THIS SURGERY?

An alveolar cleft can be mild for one child and severe for another. Even a mild cleft requires treatment. To learn about a child's case, a surgeon will examine the mouth, gums, and teeth. Sometimes, the cleft is easy to see. Other times, it can only be found with a finger or a hand tool.

The surgeon may take x-rays to learn about the size of the cleft and the health of the teeth around it. X-rays may include regular *plain films* or a low-power CT scan called a *cone beam CT scan*.

AT WHAT AGE DOES THIS SURGERY TAKE PLACE?

The timing of bone graft surgery depends in part on the growth of certain teeth. The top *incisor* and *canine* teeth are located in the front of the mouth, close to the site of the alveolar cleft (on one or both sides). The best time to do alveolar cleft repair is when those adult teeth are forming, but have not yet *erupted* (come in). This stage can happen between ages 6 and 12. The most common time is between ages 6 and 9. Once the incisor and canine teeth erupt, they will need a strong, healthy bone as an anchor.

The timing of the surgery also depends on a child's other treatments, general health, mental health, height and weight. The surgeon and orthodontist on a child's cleft team keep track of growth. Together, they decide when the time is right to schedule this surgery.

WHAT IS MAXILLARY EXPANSION?

Treatment for alveolar clefts almost always includes orthodontic care. It is common for a person born with an alveolar cleft to have an incorrectly shaped upper jaw due to the cleft. Earlier palate repair surgery, too, can impact the shape of the upper jaw. Orthodontic treatment moves the upper jaw into a correct “U” shape. It also aligns the top jaw with the bottom jaw. Most orthodontists do this treatment with a *palate expander* or another device. The process is called *maxillary expansion*.

Some children receive maxillary expansion before bone graft surgery, others afterwards. The timing depends on a child's age, the growth of his or her teeth, and the preference of the surgeon or orthodontist on the team. The surgeon and orthodontist on a child's team will work together to coordinate this treatment. In most cases, maxillary expansion lasts 6 to 12 months. A second phase of orthodontic treatment may be needed afterwards, with braces.

WHAT HAPPENS DURING BONE GRAFT SURGERY?

Bone graft surgery is performed by a surgeon on a child's cleft team. The type of surgeon varies from team to team.

For this procedure, a surgeon uses a small amount of healthy bone to patch the space of the cleft. Sometimes, this bone is “borrowed” from somewhere else in the child's body. In these cases, the surgeon's first task is to remove a small amount of bone from the *donor site* (see below for details).

Then, the surgeon operates on the alveolar cleft. To start, he or she separates the skin at the bottom of the nostril from the gums. The surgeon then repairs the nostril skin and places the new bone material (sometimes referred to simply as *the bone graft*) into the space of the cleft. Last, the surgeon closes the gums with absorbable *sutures* (stitches). With time, the new bone and old bone will join and heal completely.

WHERE DOES THE NEW BONE COME FROM?

The bone that fills an alveolar cleft can come from one of several places (each discussed in detail in the sections below). Most often, a surgeon uses a small piece of bone from somewhere else in the child's body.

Bone from your own body is called *autogenous bone*. This bone usually comes from the hip, shinbone, lower jaw, top of the head, or ribs.

Another method is to use bone from outside the body, called *substitute* bone. Substitute bone may come from a human cadaver (*allograft*), from an animal (such as a pig) or it may be man-made (*synthetic* bone).

A third method does not involve borrowed bone at all. A surgeon may choose to close an alveolar cleft with a *protein* that signals a child's body to grow new bone. When choosing a method, the surgeon considers the size of the cleft, the kind of bone needed, the health of the child, and personal preference.

BONE FROM THE CHILD'S BODY

Hip. The hip is the most common source of bone used for alveolar cleft repair. The donor site, located at the top, outer edge of the hip, is called the *iliac crest* (also called the *wing of the pelvis*). The bone of the iliac crest is plentiful and works well for grafting. To *harvest* the bone (remove it), the surgeon makes a 2-inch cut near the waistline.



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Figure 4: Iliac crest donor site

Removing bone from the hip can be painful. The pain is manageable with painkillers, which in some cases are administered with a pain pump. Most children are able to stand or walk gently a few hours after surgery. The hip area may feel numb and must be watched for infection. At two weeks, the skin incision is usually healed. At that point, most patients can walk without difficulty.



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Figure 5: Shin donor site

Shin. Sometimes a surgeon will close an alveolar cleft with bone taken from a child's shin (the *tibia*). The donor site on the shin is called the *metaphysis*. It is part of the growth plate in the bone. This area contains slightly less useable bone than the hip. While the risks of harvesting this bone are similar to the hip graft, recovery from this procedure may be shorter than for the hip.

Medical experts have shown concern that taking bone from the growth plate of growing child might cause problems with growth. However, some studies show good results and no growth problems.

Jaw. A surgeon may decide to use bone from the lower jaw (the *mandible*) to fill an alveolar cleft. A *mandibular bone graft* comes from the bone near the front of the chin, just below the bottom teeth. To remove this bone, a surgeon makes a cut on the inside of the mouth. This method works best when the alveolar cleft is small and only a small amount of bone is needed. The risks include damage to the teeth and numbness of the lip, chin and gums. However, this is a safe method to harvest bone, with few complications.



Figure 6: Donor sites in the jaw bones

Skull or ribs. In some cases, a surgeon closes the alveolar cleft with bone from the child's skull (a *calvarial graft*) or from the ribs. Bone from the skull comes from the outer surface of the head, either from the back of the head or near an ear. The rib site is located just below the breast. These two sites are used less often for alveolar cleft repair than the hip, shin, or lower jaw. They can be good options for certain cases.

BONE SUBSTITUTES

Instead of using bone from a child's body, a surgeon may close an alveolar cleft with *substitute bone*. Substitute bone has been used successfully for other types of bone grafts, such as the placement of a false tooth. This bone comes from a deceased donor (a human cadaver), a different animal species (bovine or *porcine*), or from a man-made source (*synthetic*). With substitute bone, a child avoids the risks and pain of bone harvesting. For this alveolar cleft repair, however, substitute bone may not heal as well as bone taken from the child's body.

BONE PROTEIN.

Bone Morphogenic Protein, or BMP, is an alternative to autogenous bone or substitute bone. At times, it may be combined with substitute bone. BMP sends a signal to a child's body to grow new bone. There are several types of BMP; the most common is called rh-BMP2. All BMPs are made in a lab, though BMP itself is present in one's own bone.

WHY ARE BRUSHING AND FLOSSING IMPORTANT?

A child with an alveolar cleft needs to have good dental hygiene. In the weeks and months before bone graft surgery, a child needs to brush and floss thoroughly, three times a day, to keep the teeth and mouth clean.

The cleft team recommends extra brushing and flossing for several reasons. A child with an alveolar cleft is at risk for certain problems with dental health. If a child has crowded teeth, for instance, bacteria can build up. Extra airflow from a cleft can dry out the mouth and invite bacteria, as well. An orthodontic device, like a palate expander, can also cause problems with plaque and bacteria. Without good dental hygiene, a person is at risk for tooth decay, gum disease, infections, and loss of teeth.

The health of the gums can affect the success of bone graft surgery. During surgery, a surgeon will close the gum tissue over the bone graft. Healthy gums are easy to sew. They bring good blood flow to the new bone and help with healing. When the gums are inflamed and unhealthy, they can become infected and break down. They can even cause a child to lose some or all of the bone graft.

Even with extra brushing and flossing, a child may have trouble keeping the mouth clean. A child should see a dentist regularly. The dentist will help make sure that the mouth is clean and healthy.

WHAT HAPPENS IN THE HOSPITAL?

Alveolar cleft repair is done in the operating room with full-body pain relief (*general anesthesia*). The surgery takes a few hours. Most children stay in the hospital for one or two nights afterwards.

Anesthesia and surgery cause side effects. These include sore throat, nausea or vomiting, discomfort, swelling of the face and gums, bruising, difficulty speaking and swallowing, difficulty emptying the bladder or bowels, and constipation. These side effects are usually mild. They improve in the first few days after surgery.

A child usually needs pain relievers for about two weeks after bone graft surgery. Common medications include *anti-inflammatory* medications (such as ibuprofen, with brand names Motrin or Advil), acetaminophen (brand name Tylenol), and stronger pain relievers such as *opioids* or *narcotics* (such as hydrocodone or oxycodone).

During the first two days after surgery, swelling gets worse before it slowly gets better. Swelling usually goes away completely in 3 to 4 weeks. Walking on the hip is usually painful after surgery and might put a child at risk for falling. Some children need a walker or other assistance until they can walk on their own.

In the hospital and during the first few weeks after surgery, there are a few ways to help with healing:

- Sleep on 2-3 pillows, to keep the head elevated
- Avoid blowing the nose
- Avoid pinching the nose when sneezing
- Avoid strenuous activity
- Maintain good dental hygiene

HOW DOES A SPLINT HELP WITH HEALING?

After surgery, the jaw needs to stay still so that the new bone will bond with the old bone and form a strong, healthy jaw. A *splint* is a device that keeps the upper jaw from moving. Some children with alveolar clefts on both sides may need to wear one after surgery.

A splint looks like a retainer. It is made of acrylic and attaches to the upper teeth with wires. A surgeon may recommend that a child wear the device for a few weeks to months after surgery. Wearing the splint can make eating and talking difficult. During this time, a child will follow a special diet (see below for more information).

A splint can cause plaque to build up on the teeth. A child's orthodontist will recommend ways to keep the teeth clean during this time. Sometimes, the orthodontist recommends using a small circular toothbrush, an electric toothbrush, a floss threader, or a special rinse. Patients with tooth decay may need a special fluoride treatment. Those with gum disease (called *gingivitis*) may need to have extra cleanings from a dentist before surgery and after the splint is removed.



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Figure 7: Splint stabilizing the upper jaw

WHAT CAN A PATIENT EAT AFTER SURGERY?

It is important to prevent damage to the surgical site following alveolar cleft repair. For two to three weeks after the procedure, a child needs to follow a *liquid* diet. A surgeon will then approve a *soft foods* diet. Six to eight weeks after surgery, a child will be cleared for a regular diet.

A liquid diet includes only fluids. A juicer or blender can turn most fruits, vegetables and other foods into liquid shakes. When the child is cleared for a soft foods diet, a blender or food processor will still be useful. Soft food options include mashed potatoes, yogurts, creamed soups, and anything else that can be blended. All liquid and soft foods should contain a good balance of carbohydrates, fats, and protein. A *dietician* is a professional who can give families ideas about calories and nutrition.

WHEN WILL A CHILD RESUME REGULAR ACTIVITIES?

Most children need to be out of school for one to two weeks after surgery. After that, a child can go back to school, but usually with limited activity and no gym class. Six weeks after surgery, a child can resume normal activities.

While the body heals, a child should not do any strenuous activity such as contact sports and heavy lifting. Surgeons do suggest walking and stretching. If the surgical procedure included bone removal from the hip or shinbone, a child may feel some pain in those areas. In some cases, a *physiotherapist* may suggest that a child use a walker.

WAS THIS SURGERY A SUCCESS?

After surgery, the gum tissue at the area of the bone graft should stay closed. When the adult teeth come in, they should have good support from inner bones and gums. Six to twelve months after surgery, a child may have an x-ray called a *radiograph*. The radiograph shows if the bones have healed well.

The success of a child's bone graft surgery depends on a few factors. These include a child's age, general health, whether the teeth entered the cleft site before surgery, the size and shape of the cleft, the health of the gums, surgical technique, and other factors.

In some cases, a bone graft may not be successful. When this happens, a surgeon usually recommends additional bone grafting. This decision usually takes place at least 6 months after the first surgery.

Treatments for alveolar clefts will vary from one cleft team to another. The surgeon on your child's cleft or craniofacial team can give information on your specific case.

FOR MORE INFORMATION

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