

August 10, 1983

News

The University of Texas Health Science Center at Dallas
5323 Harry Hines Boulevard Dallas, Texas 75235 (214) 688-3404

CONTACT: Liz Willding
Office: 214/688-3404
Home: 214/620-8654

****With proper emergency care, surgeons can restore function to reattached limbs.**

DALLAS—The fingers on her left hand produce a rolling sound as she taps them, one after another, on the desk. Next she scratches her temple with her left index finger. Then, lowering her arm, she brings both of her hands together at the fingertips.

While Christie Legg's gestures may seem normal, they are really monumental. Three years ago the 25-year-old almost severed her left hand in a band saw accident. Thanks to good emergency care, the painstaking work of a team of surgeons and a lot of follow-up therapy, her replanted hand now functions almost as well as it did before.

"Christie Legg's recovery is exceptionally good," says Dr. John Tebbetts, reconstructive and plastic surgeon. "Not only does she again have her hand, but she also has a functioning hand — and that's the whole point of reconstructive surgery."

Tebbetts is assistant professor of Surgery at The University of Texas Health Science Center at Dallas and was part of the team that rejoined Legg's hand. He reattached her blood vessels and nerves to give her hand a blood supply and sensation. Since the original surgery, he and Dr. Peter Carter (orthopedic surgeon, Baylor University Medical Center in Dallas) have performed several other operations to improve its function and appearance.

Tebbetts says emergency departments see hundreds of cases of severed body parts each year. The majority of these are hand trauma. Fingers lost in industrial accidents are by far the most common. He says much of what will determine whether an amputated part can be replanted is determined by first aid care.

Success also depends on what has been amputated and the length of time that has lapsed between the accident and surgery. "The muscles present the most problems in terms of time. The larger the part that is amputated, legs and arms for example, the more muscle you have to contend with. The muscle begins to break down when deprived of blood supply, and a lot of toxic products may circulate when reattachment is performed. These can cause kidney and liver damage. We'd be hesitant to reattach a leg or forearm after six hours, even if it were cooled.

"When an amputation occurs, the most important thing to do initially is put the part in a plastic bag to maintain moisture and put the plastic bag on ice. Then seek emergency care."

Tebbetts emphasizes that an amputated part, no matter how damaged, should always be retrieved and brought with the patient to the hospital. If it is a partial amputation, the remaining tissue should be left intact. And, while it is important to cool the part, it is just as important not to freeze or soak it. The part should not be packed in dry ice or covered in water.

Legg's amputation occurred when she was using a band saw to make an art sculpture. She attempted to round the edges of the wooden art project by twisting the piece as she guided it against the band saw blade. Her hand jerked through the saw, possibly when her watch chain caught in the blade, and was severed except for a small portion of skin on the top side of her wrist.

"In hand trauma cases, power machines are one of the main culprits," Tebbetts said. "Most are industrial accidents occurring when these tools are used on the job."

Plastic and reconstructive surgery is also needed in trauma cases where large areas of skin and bone are torn away. He and his colleagues transfer tissue and bone to replace missing tissues resulting from injuries, such as those caused by motorcycle and auto accidents.

"During the spring and summer when the weather is nice, we begin to see more motorcycle accidents. Injuries are usually on the lower extremities and involve loss of bone and soft tissue. We also see a lot of facial trauma, primarily from automobile accidents."

He explained that when local tissue is not available, the transplants are taken from other areas of the patient's body. Distant transfers require microscopic attachment of blood vessels to provide blood supply to the transferred tissue. Using this "borrowing" technique, they are able to reconstruct certain body parts that have been damaged or were not retrieved.

"Moving body parts is another option. Toe-to-hand transplants to replace lost fingers are becoming more and more common.

"We can satisfactorily reconstruct almost any part of the body using local or distant tissue transfers," Tebbetts said.

A total limb transplant requires rejoining muscle, tissue, tendons, bone, blood vessels and nerves. Christie Legg's first surgery took Tebbetts and his team more than 13 hours to complete.

"Normally you choose the most efficient, yet simplest method of providing reconstruction. In some cases you may need to reconstruct only some of the structures. In Christie's case, because her hand was almost totally severed, we had to deal with virtually every structure."

Surgery in total replant operations begins by realigning and stabilizing bone. Orthopedic surgeons reattach the bones using plates and screws. Next the plastic and reconstructive surgeon rejoins the blood vessels, nerves and soft tissues.

Establishing blood flow to the part gives it life. Tebbetts explained that the technique is a lot like putting two pipes together. "With the help of the microscope we are able to identify the ends of the vessels and sew them back together. We have relatively passed the point where blood flow is a problem. Our rate of failure due to vessel clotting is less than five percent in cleanly amputated parts."

He says rejoining the nerves is another matter. "Picture a nerve as a cable about the size of a pencil. That nerve may have many thousands of individual nerve fibers within it. These are bound in about 10 or 12 bundles. We try to match up and sew together these bundles, but there is no way we can exactly match all the thousands of fibers within each one."

In theory it might be possible to increase magnification so as to see the internal fibers and attempt to sew some back together. But he says the limiting factor is not the magnification. "Sheer numbers would make it prohibitive, but more limiting than that is getting suture material that tiny."

"You can lay a human hair under a microscope and drive at least two needles through it, side by side, with the material we use. It is very, very small, but it would have to be a lot smaller to sew individual fibers inside the bundles."

Some "short circuiting" will occur, Tebbetts says, but if sensation can be achieved, further improvement may be gained by "re-teaching" the brain with therapy. "Assuming you have blood supply, the nerve recovery almost totally determines the result. If you can't feel, you can't do adequate therapy later on."

When the nerves and veins are reattached, the orthopedic or plastic surgeon rejoins the tendons, muscles and skin, completing the surgery.

In hand trauma cases where fingers are unretrievable or are too damaged to reattach, toe-to-hand transplant offers an option. Tebbetts says this is done most often when a person loses a thumb.

"The thumb accounts for about 50 percent of hand function, and its loss creates quite a disability. Replacing it with a great toe or second toe is a highly effective alternative." In the past the classic procedure was to move a person's index finger into the thumb position to give them pinching ability. Problems with this are that it "steals" normal tissue from the hand and may not have as good pinch strength as a transferred toe.

The surgeon says he has found that it is culturally less detrimental for patients to lose their great toes than it is to lose their index fingers. And new studies show that if the toe is removed, preserving bone in the "ball" of the foot, the foot can bear weight with little or no change in gait. The patient's weight is simply redistributed to the other toes.

He says toe transplants are also useful for children who are born without fingers. If all other functional units are intact (muscles and tendons in the forearm), transplanting at least two toes to the hand can give them the ability to pinch and grasp.

Where replantation or transplantation are not possible, rebuilding body parts offers another option. "All body structures are subject to loss, and they are all reconstructable to some degree. Other examples might be someone's going through the windshield of a car and having an ear amputated or surgical removal of a nose or breast due to cancer."

"One alternative is to provide these patients with prostheses (artificial parts made of plastic or other materials). But there is no way a prosthesis can ever become part of you. You can never incorporate it into your self-image; it is always a "thing" you have to put there."

"Unless there are major medical reasons preventing reconstructive surgery, for example severe heart disease, we usually recommend reconstruction using the patient's own tissues."

Reconstructing a body part is a lot like sculpting. In the case of an ear or a nose the surgeon borrows cartilage, usually from the patient's ribs, to carve a new framework. Then tissue containing blood vessels is molded and draped over the framework. Reconstructed parts may not have all of the detail of the original structure, but in most cases are functionally and aesthetically superior to a prosthesis," says the surgeon.

Whether reattachment, transplant or reconstruction, Tebbetts says every operation has a range of expected results. In reattachment and transplant cases, patient compliance is especially critical to the success of the operation.

"Any type of reattachment surgery, whether it is a hand or fingers, requires many hours of therapy. Technically, even if we do everything perfectly in the operating room, if the patient does not comply with therapy, optimum results cannot be expected."

In Christie Legg's case, therapy was especially critical. Soon after her surgery she was equipped with a brace that gently applied downward pressure on her finger tips. This applied pressure on her hand tendons, slowly breaking scar tissue so it would not become permanently stiff.

At different stages of her therapy, three more surgeries were necessary to help her regain optimum function and appearance.

"The first surgery was to free up scar tissue that had formed. The next one was to repair a tendon that had come loose, and the last one was to improve my thumb rotation. I wasn't able to grip anything; my thumb wouldn't curve around like it normally should," she said. To give it more rotating ability, Carter moved the end of a muscle in the palm side of her thumb to the top knuckle area.

While Christie says she can't grip with her left hand as well as with her right, her function is near normal. She can't play the piano as well as she used to, but she can use a typewriter and perform most routine tasks. "I drop things every once in a while, and I have to watch my hand when I type," she said.

"I've got good hot and cold protective senses and the feeling in my hand is kind of like when your foot goes to sleep. It tingles, and it is more sensitive than my other hand. I have a hard time judging my strength, and if it is cut, it doesn't heal as fast as the other hand. It never bruises, and it gets cold easily. In the winter I wear gloves a lot."

Christie's therapy sessions began with three or four visits per week. They tapered off to twice a week and then once a week. She is now officially "finished with therapy," but her doctors tell her her function should improve even more with use.

Christie says it wasn't easy to stay motivated. But the support of her family and friends helped a lot.

"At first, you are in shock. It's scary to know that you have something stuck back on but you can't feel it and you don't know if it is going to be like a piece of wood. You don't know if you'll ever be able to use it. It's not like breaking your leg where you can feel everything, and you know that sooner or later it is going to heal.

"This is something weird like Frankenstein. It is easy to get depressed because, all of a sudden, you are having to let somebody else button your clothes, fix your hair, tie your shoes, open your doors and drive for you.

"You have to learn to let people help you; you have to let them love you. You also have to deal with the reactions and stares of people. That can be hard; it can make you paranoid.

"For the longest time when people would look at me they would look at my hand and not my face. For a while I just wouldn't go anywhere. Then I decided that I couldn't stay in the house forever so I started going out and doing things. I went back to school and graduated."

Since that time Christie Legg has married. She now works two part-time jobs, and on the weekends she and her sister clean her father's dental office for extra money. Three years following her accident, she says her life is back to normal. Occasionally she encounters something she can't face. When Darth Vader severed Luke Skywalker's hand in "The Empire Strikes Back," she had to excuse herself from the theater. However, for the most part, she's learned to cope with her accident and recovery.

"Normalcy is what we want to help the patient achieve," Tebbetts said. "We want to help them regain function, and we want whatever we do to be as inconspicuous as possible. There are always limitations, and there are always trade-offs. It is important that the patient and the physician both recognize this."

Tebbetts feels that reconstructive surgery and aesthetic or cosmetic surgery (elective surgeries to improve personal appearance) are mutually dependent. "In either situation you are trying to help the patient achieve a better self-image. With trauma cases you are usually dealing with an involuntary situation, but the damage to the self-image may be similar to that seen in the cosmetic patient.

"Our goal is to provide function, but close behind that we want to make whatever we do as aesthetically pleasing as possible. The two are inseparable. The idea is to take away or improve what is bad, leaving what is good. The less conspicuous change is often the best. A poor result often is an excessively obvious result. I personally feel that aesthetic surgery of any sort is at least as just as any other investments to achieve personal gratification."

In the '70s actor Lee Majors stimulated public interest in rebuilding body parts as the bionic "Six Million Dollar Man." "Star Wars" hero Luke Skywalker received a bionic hand to replace the one Darth Vader flailed away. But bionics represents hardware. Tebbetts says it is his goal to make living improvements -- perhaps the most futuristic concept of all.

###

DISTRIBUTION: AA,AB,AC,AF,AG,AH,AI,AK