



Hughston Health Alert

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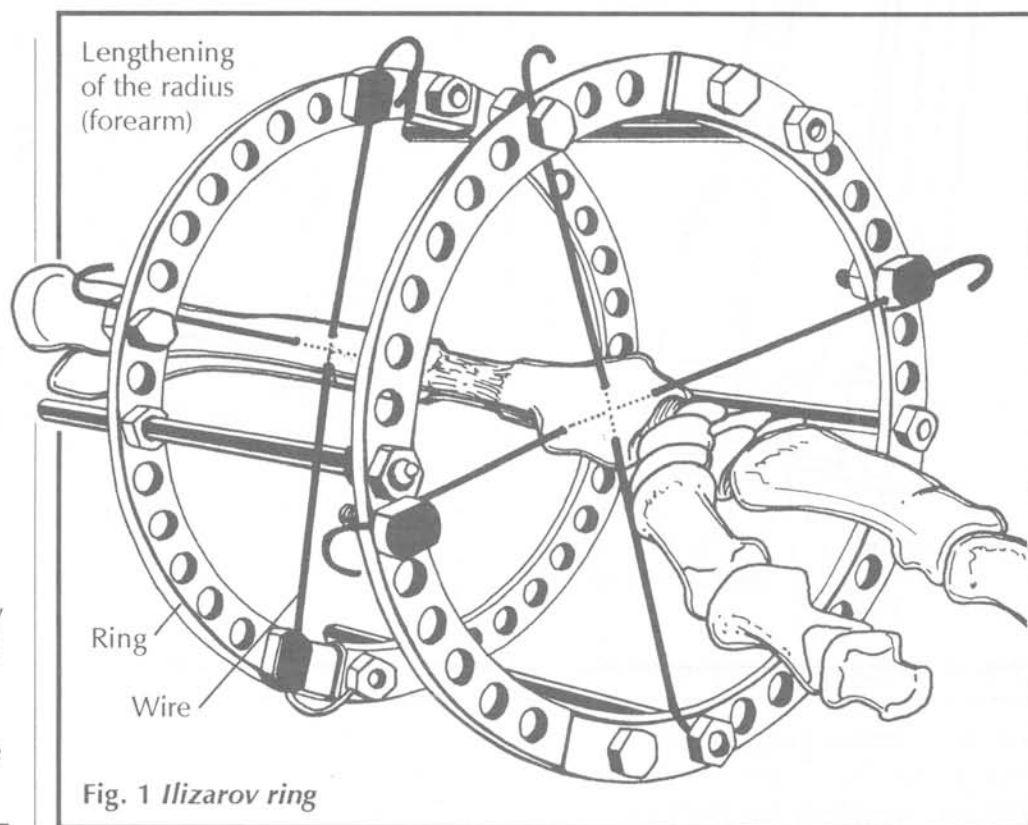
For a Healthier Lifestyle

SPRING, 1994

Three Men, Three Fixators

New Ways to Fix Broken Bones

About 40 years ago, a Russian physician named Gavriil Ilizarov began treating fractures and deformities in obscurity in the small town of Kurgan in Siberia. Because modern supplies and equipment were so scarce, Ilizarov was literally forced to go into his workshop and create crude versions of external fixators (devices worn outside the body and used to hold the ends of broken bones together). His fixators consisted of many rings connected by threaded rods. Thin, highly tensioned wires attached to the ring on one side, passed through the skin and bone, and attached to the ring on the other side (Fig. 1).



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Although the devices that Ilizarov made were first used to stabilize fractures, his curiosity led him to use his external fixators to study how fractures heal. Ilizarov learned that before the healing bone tissue in a fracture calcified and became solid, it could be molded and shaped to straighten a poorly aligned fracture. From these early observations, he reasoned that if a poorly aligned fracture could be corrected, then a crooked bone could be straightened

by making a fracture in the bone and molding the healing tissue. Ilizarov began experimenting with deformity correction and eventually with transports of bone segments to fill in large gaps where bone was removed in surgery or lost because of injury.

He became quite renowned in the Soviet Union, but few physicians outside of that country knew of his work until the 1980s. At this time physicians from around the world were allowed into the Soviet Union,

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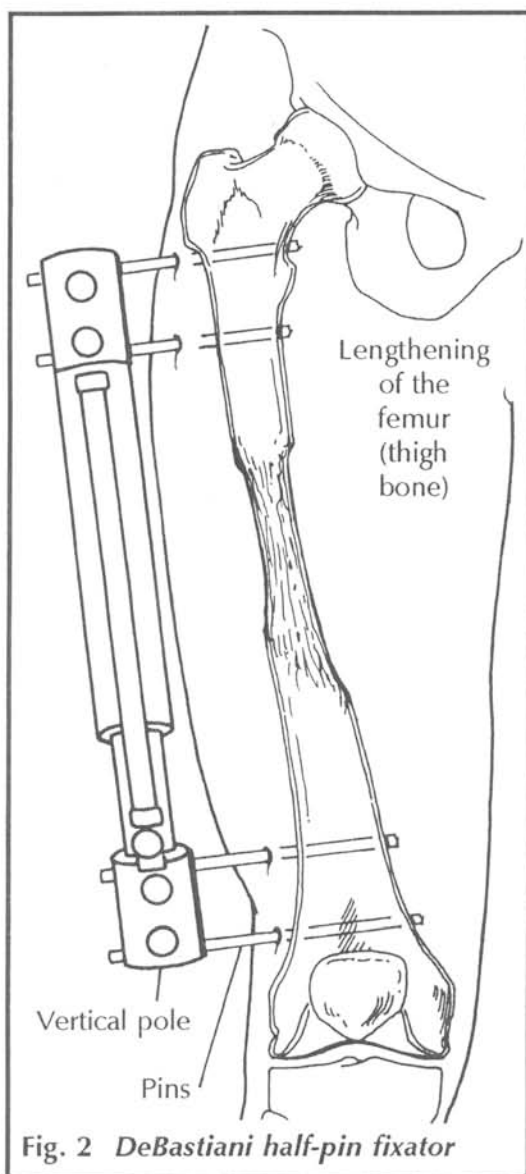


Fig. 2 DeBastiani half-pin fixator

and they came to Kurgan to study with Ilizarov. When they returned to their own countries, the physicians applied the techniques Ilizarov had discovered about bone healing and the use of external fixators.

DeBastiani, an Italian physician who studied with Ilizarov, designed an adjustable external fixator with one vertical pole and large pins that penetrated the skin and the bone (Fig. 2). Instead of passing completely through the limb like the wires in Ilizarov's external fixator, the pins passed through the skin on one side and anchored in the bone. This radically different, simpler design

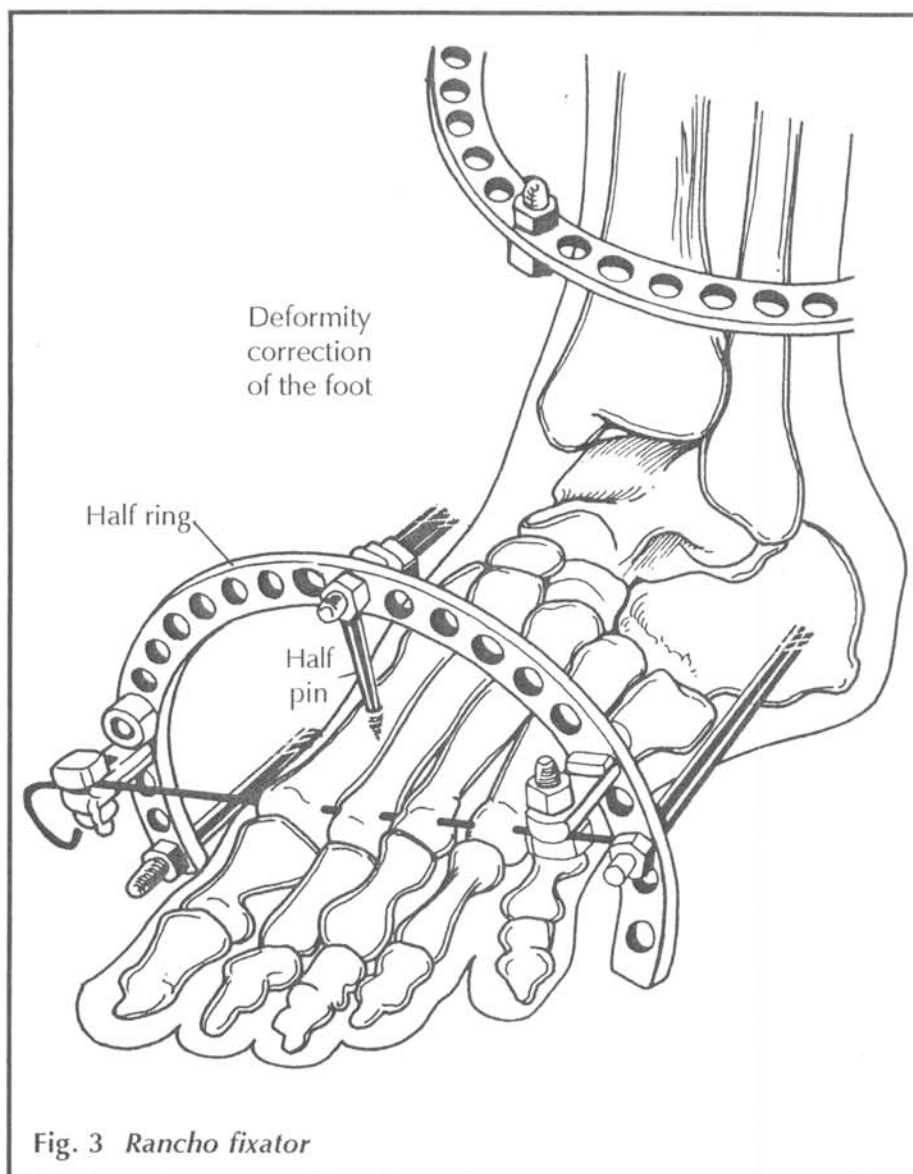


Fig. 3 Rancho fixator

called the Orthofix could also help correct deformities, lengthen bones, and transport bone segments.

Stuart Green was one of three physicians from the United States who studied with Ilizarov and DeBastiani. When Dr. Green returned to the United States, he began performing the Ilizarov and DeBastiani techniques at Rancho Los Amigos Medical Center in California. He worked with an engineer to develop the Rancho external fixator that combined the rings of Ilizarov that formed a half ring around the limb (called half rings) and the pins of DeBastiani that anchored in the bone

(called half pins) (Fig. 3).

Because of Ilizarov's work, external fixators are now used for more purposes than just holding fractured bone in place. Now three basic types of external fixators, the Ilizarov ring fixator, the DeBastiani half-pin fixator, and the Rancho fixator combining half rings and half pins, are used to correct deformities, lengthen shortened limbs, and replace missing segments of bone. Many adaptations of the basic fixators are now available.

*Fred Flandry, M.D.
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The External Fixator

What is an external fixator? It is a device used by orthopaedic surgeons to hold the ends of a broken bone together while they are healing. External fixators are different from casts or internal fixators. Casts use pressure on the soft tissue of your arm or leg to hold the broken ends together. Internal fixation is a surgical technique that involves fixing the ends of the bone in place using pins or screws or using a metal plate that is attached to the side of the bone. With external fixation, the pins are placed through the skin and directly into the bone. The other ends of the pins are attached to a rigid frame called an external fixator.

The actual insertion of pins is a minor procedure that can be done on

an outpatient basis. The surgeon studies x-rays of the fracture to decide the correct place to insert the pins. After studying the x-rays, he or she locates areas called safe zones where pins can be inserted without damaging nerves, blood vessels, or other tissues. The surgeon makes an incision in the skin then pushes a hollow blunt instrument through the soft tissue to the bone. Next, the surgeon puts the drill bit into the hollow instrument and drills into the bone. Finally, he or she inserts the pin into the drill hole in the bone. The other end of the pin that extends from the arm or leg is attached to a metal frame (Fig. 1 and Fig. 2).

The number and size of the pins used depends on the location and severity of the break. Once the pins are attached to the frame, the rigid

structure keeps the broken bone immobile and allows it to heal in the correct position.

External fixators are used to treat complex fractures and fractures with large skin wounds that cannot be covered by a cast. They may be used to allow wounds to heal or to allow motion in a nearby joint so the joint will not become stiff.

In addition to fracture care, there are other uses for the external fixator. Today, different devices are available for shortening, lengthening, or straightening out deformed arms, legs, hands, and feet. Some are small enough to be used on a finger, and others extend from the hip to the foot.

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Fig. 1

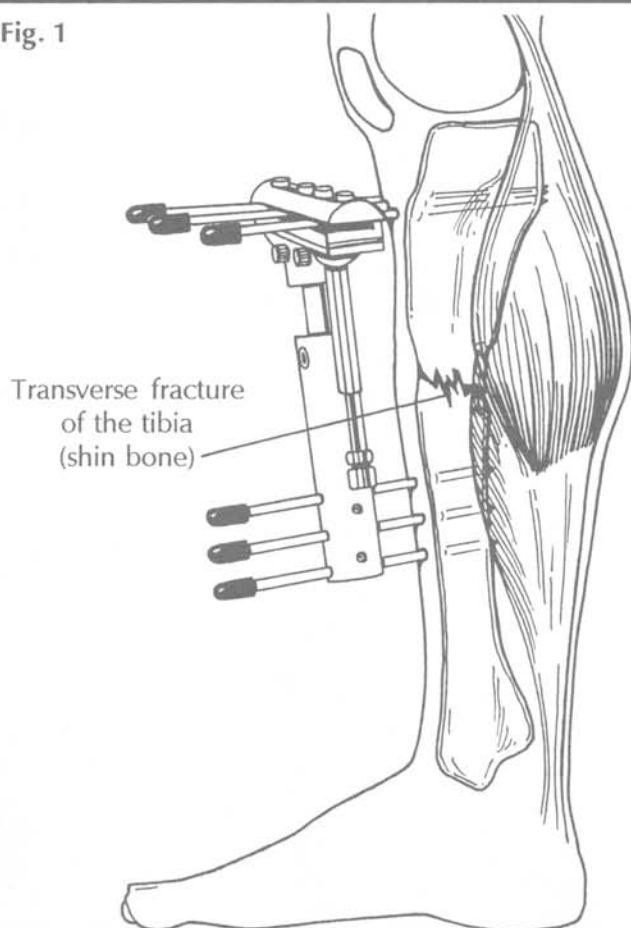
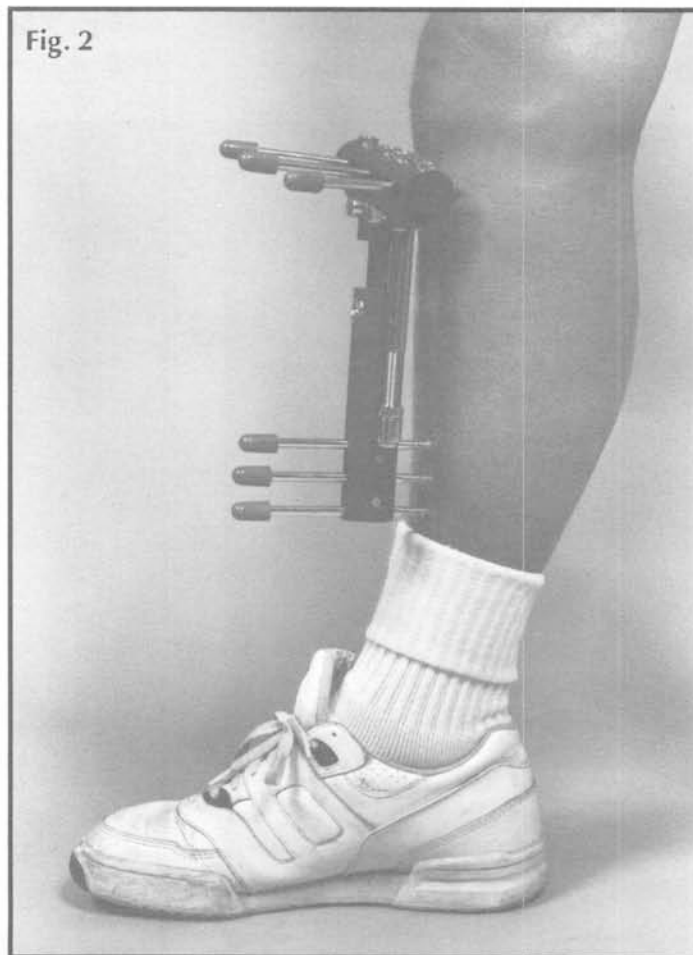


Fig. 2



Not Just for Broken Bones

Bone Lengthening and Correction of Deformity

The correction of deformed arms and legs has always been one of the primary goals of orthopaedic surgeons. When someone is born with a crooked bone or has a broken bone that does not heal straight, the orthopaedic surgeon can make a new break to allow the bone to heal straight. Recently, orthopaedic surgeons have begun using external fixators to correct these deformities in a new way. Instead of just holding the bones together in one place, the external frame can be made adjustable so the orthopaedist can "fine tune" the healing.

Reshaping the body

Sometimes bone and joint deformities occur at birth or result

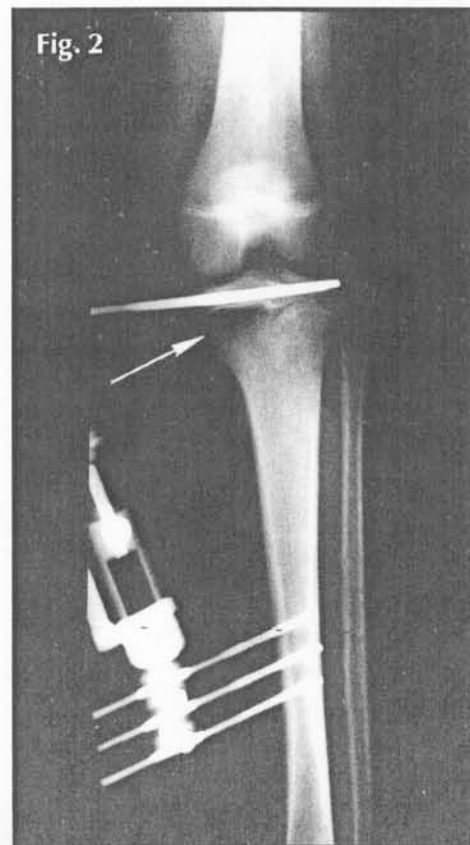
from a disease. Using adjustable external fixation devices, an orthopaedist can help your body grow new bone to correct the problem. For example, in people with Blount's disease the inside of the tibia, or shin bone, stops growing prematurely. As the other side of the bone continues to grow, the person develops very bowed legs. To correct this, a surgeon places the pins of an adjustable external fixator above and below the growth plate of the tibia and makes a fracture on the inside surface of the bone (Fig. 1). The ends of this fracture are slowly moved apart as the patient turns a screw on the fixator one quarter turn four times a day. This slow pulling apart, or distraction, gives the body time to grow new bone in the space (Fig. 2) and straighten the leg to normal (Fig. 3).

This same technique can be used to lengthen bone in people who have one leg shorter than the other. Unequal leg lengths can cause

problems with walking or pain in the hip and back because the inequality changes the normal alignment of the body and shifts the forces on the joints. To lengthen the shorter leg, the surgeon cuts all the way around the hard surface of the bone and places an adjustable external fixator on the leg. By moving the cut ends of bone apart very slowly, the body has time to grow new bone and stretch the surrounding muscle and skin. It takes about 8 weeks to gain an inch of length. Although patients sometimes report discomfort in the area where the pins pass through the skin, they report the actual lengthening process is painless.

Advantages and disadvantages

There are several advantages to using external fixation over older conventional appliances. Adults, as well as children, can be treated for deformities because our bodies can build new bone at any age. Any



amount of bone can be created given enough time. The immobilized arm or leg can be elevated without putting pressure on the soft tissue of that limb. Finally, only small incisions are needed to apply the device because everything is controlled from outside the skin.

The disadvantages are that the techniques require extensive patient participation and cooperation, the devices are outside the skin and can interfere with clothing, and the process can take several months to complete.

The potential of these new external fixation techniques to treat bone shortening and deformity is exciting. Experience and research will undoubtedly lead to further improvement of these techniques.

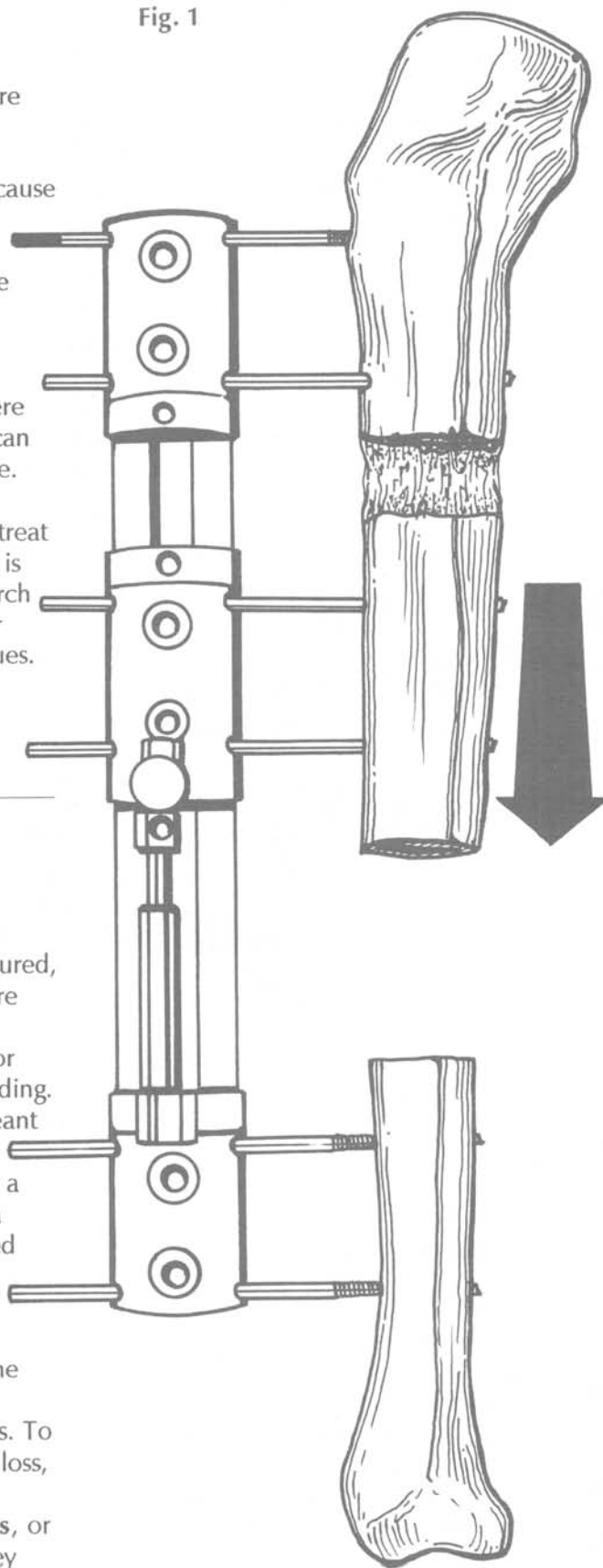
*Todd A. Schmidt, M.D.
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Bone Transports

Filling the Gaps

Many times when bone is injured, infected, or cancerous, an entire portion of the bone must be removed to treat the problem or prevent the disease from spreading. In the past, this loss of bone meant many patients had to have a limb amputated or had to wear a brace to support and stabilize a limb. Some people were treated successfully by having bone transplanted from another part of their body or from a donor. However, most attempts at bone transplants were not highly successful or reliable treatments. To find a better way to treat bone loss, physicians built on Dr. Gavril Ilizarov's teachings of **callotaxis**, or stretching of healing bone. They found that a small fracture could be

Fig. 1



created in the bone some distance from the place where bone was removed. As the newly created fracture began to heal, the section of bone between the new fracture and the missing bone could be transported across the gap where no bone existed. New living bone would grow and fill in behind the transported segment.

Transporting bone

Before bone transport begins, the surgeon places an external fixator with pins or wires into the bone next to the gap where bone has been lost (Fig. 4). The surgeon makes the new fracture by cutting the cortical, or surface, bone in a process called corticotomy. Pins are placed in the segment of bone to be transported, and these are connected to the external fixator. The crack is allowed to begin healing for 5 to 10 days, then the patient turns a small bolt on the fixator four times a day to move the bone segment. The segment moves about 1 mm per day, and new bone begins to grow in the path behind the segment as it is transported over the gap. This new bone initially contains no calcium; therefore, it cannot be seen on x-rays for several weeks. First, the new bone appears as small white streaks on x-rays. Eventually, the streaks grow more and more dense and ultimately resemble mature living bone.

Closing the gap

Because the process of bone transport is slow, a gap of 2 1/2 inches takes about 2 months to fill completely. Surgeons refer to the meeting of the transport segment with the bone at the opposite end of the gap as docking. Just before docking, it is usually necessary to perform a second small operation. Surgeons apply a bone graft to help

the ends of the bones heal. After docking, the external fixator must remain in place until the newly formed bone is completely calcified and strong. The fixator can then be gradually loosened and removed.

The application of the fixator, the initial cracking of the bone, and the later bone graft are usually minor procedures so patients only stay in the hospital a short time with each procedure. The fixator can be removed in the doctor's office.

The prospect of transporting segments of bone has given people the hope of replacing bone lost because of trauma, infection, or cancer.

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Smoking -- Can It Affect Bone Healing?

Tobacco use has been associated with many illnesses including heart disease, blood vessel disease, and several forms of cancer. In addition, research has shown that skin wounds heal slower in people who smoke cigarettes. Now, there is also some evidence that bone heals slower in smokers than in nonsmokers.

Recently, Dr. George Cierny III and his colleagues studied the role of tobacco smoking in bone healing. The study, which was conducted at Emory University in Atlanta, revealed that bone formation during bone transports was much slower in patients who smoked than in patients who did not smoke (See Bone Transports, p.5).

The researchers studied 29 patients who were being treated for a fractured tibia (shin bone) and who developed infection of the bone

(osteomyelitis). Patients answered a questionnaire regarding their smoking history. Also, each patient had blood and urine tests to verify his or her exposure to nicotine and cotinine, which are contained in tobacco. The patients were divided into groups of nonsmokers, former smokers, and current smokers.

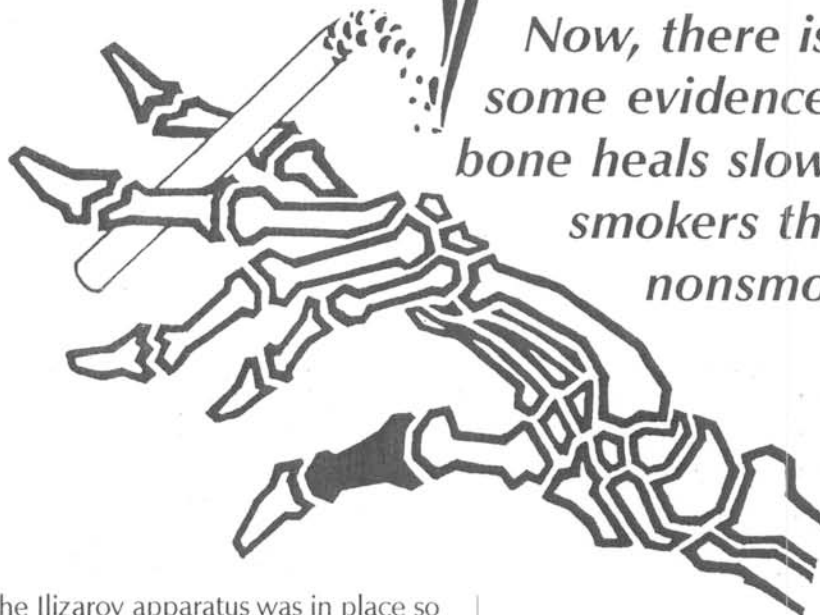
The infected bone was removed in all of the 29 patients. The physicians used the Ilizarov external fixation device to allow new bone to form during bone transport.

The physicians took x-rays of the patients' legs at different times after

It is difficult to pinpoint the exact cause of the slower healing rate in smokers and former smokers. There are thousands of different chemical substances known to be harmful in cigarette smoke. Also, the effect of other types of tobacco products, such as snuff or smokeless tobacco, on the healing rate of soft tissue and bone is unknown.

One researcher at the University of California in San Francisco thinks nicotine may cause bone and soft tissue to heal slower in smoking patients. The nicotine in cigarette smoke reduces the amount of oxygen

Now, there is also some evidence that bone heals slower in smokers than in nonsmokers.



the Ilizarov apparatus was in place so they could assess the rate of healing. They found that the nonsmoking patients formed new bone much faster than the patients who continued to smoke during the study. The average length of time for a nonsmoker to form 1 cm of new bone was 69.6 days, compared with 89.4 days for the smokers. Based on this rate, if a patient needed to form 5 cm (2 inches) of new bone, it would take 10 months for a nonsmoker and 15 months for a smoker. Former smokers also healed slower. Based on their rate of healing, it would take 13.6 months for a former smoker to form 5 cm of new bone.

that reaches healing tissues. This lack of vital oxygen severely hampers the healing of all tissues, including broken bones.

During the past 20 years researchers have found more evidence that cigarette smoking causes serious health problems. Now researchers at Emory University and the University of California at San Francisco have linked cigarette smoking with delayed healing of bone.

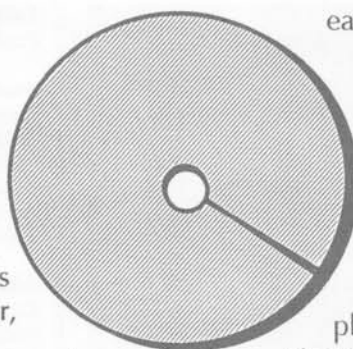
*Joseph A. Martino, M.D.
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Use of BIOPATCH™ Antimicrobial Dressing in External Fixation

External fixation is a safe and effective way to treat a bone that is fractured in many places. However, about 20% of patients develop an infection around the site where the fixator pin is inserted into the skin and bone. The infection is called a pin tract infection, and it causes pain, redness, and drainage around the pin site. Sometimes the tract gets infected because your body is fighting against bacteria that have entered the pin tract or because soft tissue has become irritated after rubbing against the pin constantly. Your surgeon may have to remove the fixator to stop the infection from spreading.

To find a better way to prevent pin tract infections, physicians at The Hughston Clinic are involved in a research project with a new product called the BIOPATCH™ (by Johnson & Johnson Medical, Inc.; Arlington, Texas). They will determine how well the product prevents these infections. The BIOPATCH™ is a thin, foam, adhesive patch filled with chlorhexidine gluconate, a well-known antiseptic agent that has been used for more than 30 years as a medical disinfectant. This safe and effective antiseptic is used to wash hands, to disinfect skin, and to rinse wounds during surgery. The spongy patch is placed on the skin around each pin so the antiseptic can coat that area.

Patients in this research project will be randomly assigned to either the study group or the control group. Patients in the study group will have the BIOPATCH™ dressing applied immediately after their fixator is in place. They will have a new set of patches placed around the pin sites



each week until their fixator is removed.

Patients in the control group will have the standard treatment of gauze dressings placed around the pin tract and will also

have weekly dressing changes.

The physicians involved in this project hope that the people in the

study group will develop fewer pin tract infections than those in the control group. If this happens, Johnson & Johnson Medical, Inc. will share the results of the study with other orthopaedic surgeons so they will know that the BIOPATCH™ is a safe and inexpensive way to prevent pin tract infections. Use of the patch will make external fixation an even safer way to treat complex fractures.

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ATHLETIC TRAINING CORNER

Sports Medicine in the School

School administrators find that hiring a full-time athletic trainer is the best way to provide health care for high school athletes. The close relationship that develops enables the athletic trainer to better meet the health care needs of the athlete. Athletic trainers work under the direction of physicians and help extend their services to student athletes.

Athletic trainers can help prevent injuries by ensuring the playing area is safe, teaching athletes proper conditioning exercises, and preventing heat-related illness. They organize preparticipation physical examinations to screen for general medical and orthopaedic problems. If detected early, problems can be treated before the athletic season begins and injuries can be prevented.

Full-time athletic trainers supervise practices and games where they provide immediate and appropriate first aid if an athlete is injured. They can refer the injured athlete to the appropriate medical professional for further care. Because they saw how the injury occurred, the athletic trainers can give the physician important information about what anatomic structures may be injured. Also, they can help the athletes complete their rehabilitation program and return to sports activities quickly with little risk of reinjury.

The athletic trainer is a qualified administrator for a high school sports medicine program. He or she keeps accurate records of injuries and treatments and helps athletes and their parents understand the diagnosis and follow the prescribed treatment.

Hiring full-time athletic trainers is cost-effective for the school because they can help reduce both medical and liability insurance costs. The Hughston Sports Medicine Foundation, Inc. is available for additional consultation to develop the best sports medicine program for your school.

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Ask the Doctor

Answers to your questions about musculoskeletal health.

Q Can sciatica be treated without surgery?

A Yes. In fact, sciatica is never treated with surgery. Sciatica refers to pain in the legs or buttocks. It may be caused by many different problems including a pinched nerve or muscle spasm. The treatment is aimed at controlling the pain and preventing it from returning. The most effective treatment is rest, but total bedrest is no longer recommended because you lose muscle tone. Other common treatments include wearing supportive garments and doing pool exercises that do not strain the lower back. Analgesics, or pain killers, can give some relief, but it is better to relieve the pain through joint manipulation or soft tissue relaxation techniques that allow you to remain active while your pain is diminishing.

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The Hughston Health Alert is a quarterly publication of the Hughston Sports Medicine Foundation, Inc. The Foundation's mission is to help people of all ages attain the highest possible standards of musculoskeletal health, fitness, and athletic prowess. Information in the Hughston Health Alert reflects the experience and training of physicians at The Hughston Clinic, P.C., of physical therapists and trainers at Rehabilitation Services of Columbus, Inc. and Committed Fitness Systems, of physicians who trained as residents and fellows under the auspices of the Hughston Sports Medicine Foundation, Inc., and of research scientists and other professional staff at the foundation. The information in the Hughston Health Alert is intended to supplement the advice of your personal physician and should not be relied on for the treatment of an individual's specific medical problems.

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Walking for orthopaedic research!

Come join physicians, former patients, and friends at the Hughston Sports Medicine Foundation and help raise money for orthopaedic research and education.

Sunday, June 12, 1994

2 PM Registration

3 PM 1-mile walk

3:30 PM Post-walk celebration

For more information,
call (706) 576-3380.



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