



Advanced Limb Correction and Fixation Technology



Orthopaedics

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A Patient's Guide

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Standing

Move forward to the edge of the chair. Push off against the seat using the hand on the affected side. Push down on the hand piece while raising the body to a standing position (Schoen, 2000).

Using the Toilet

- Follow the same steps used in sitting and standing for getting on and off the toilet.
- Consider using an elevated toilet seat.
- For safety purposes consider placing handrails beside the toilet.

After the Fixator is Removed

When your doctor is satisfied with the strength of the new bone, the fixator will be removed in a same-day or outpatient surgical procedure. Many times a cast will replace the fixator to support the new bone for a few weeks. At first, you will have certain physical limitations, depending on your bones and specific situation (no high-impact activities such as jumping, skiing or tennis). Consult your physician about any specific physical activity.

Partners in Success

Throughout this process, we hope that you remain mindful of the fact that your physical and mental well-being are very important to your team of caring specialists and loved ones. Never hesitate to call on them for help, advice or just to talk. They are dedicated to your success.

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The ILIZAROV™ Method

This booklet addresses many of the most frequently asked questions specific to the ILIZAROV method of external fixation. It is not presented as a substitute for direct communication with your surgeon's office should you have question.

Special thanks to Lisa P. Underwood, R.N., Dror Paley, M.D. and all those who made contributions to this brochure.



Activities of Daily Living

More time, preparation, energy and rest will be needed to perform activities such as cooking, cleaning, shopping, walking, dressing, bathing and laundry. You may need the assistance of significant others to help you through this. After all, you are limited as to what you can do. If you live alone, make arrangements for someone to help you with these activities. Contact a social worker or home health nurse to assist you with these arrangements.

Positioning the Affected Extremity (Schoen, 2000)

- Immediately after surgery, the affected extremity should be elevated above the level of the heart until there are no concerns about swelling. To elevate the affected extremity properly, place a pillow under the heel of your foot so that the knee is extended fully.
- To move the affected extremity, the leg external fixator must be moved together as a unit. The amount of assistance needed depends on your ability to control the leg during the move. Make sure not to place your hands under the fracture site during movement. This may cause you to apply stress and even slightly manipulate the fracture site.

Sleeping

- The body may require more sleep during the time of external fixation due to increased demands in ambulation and other activities.
- Your sleep is limited to one position — your back. Elevate the leg with pillows to secure the position of the extremity and provide comfort.
- Consider sleeping with the fixator-frame cover to avoid ripping the sheets.

Sitting

Walk to the chair with your crutches, turn around slowly, and back up to the chair until the back of the unaffected leg touches the seat. Grasp both crutches at the hand pieces using the hand on the unaffected side. Bend forward slightly while assuming a sitting position. Grasp the seat of the chair with the hand on the affected side, move the affected leg forward, and gradually lower yourself onto the seat (Schoen, 2000).

Is the Procedure Right for You?

Limb correction is a gradual process, which lengthens and/or straightens bone and soft tissue so a limb can function as normally as possible. While there are many reasons a patient would choose to have this type of procedure, the primary indications include trauma, congenital deformities and bone or joint infection.

Your orthopedist uses the ILIZAROV™ surgical method to correct a deformed limb. This remarkable technique uses a device called the TAYLOR SPATIAL FRAME® to take advantage of the body's natural ability to grow healthy new bone tissue.

The two phase process typically takes 12 months to complete, during which the bone shape is gradually corrected and then is precisely held together by the TAYLOR SPATIAL FRAME. Even as the bone hardens and matures in the anatomically correct length and alignment, the device allows for a reasonable level of physical mobility.

This procedure can work for both children and adults. Children with congenital deformities may often suffer from unequal leg lengths. In the same way, an adult may have experienced one of these conditions for many years, and may now suffer from back pain and arthritis caused by the leg discrepancy.

Conditions Treated

External fixation can be used to correct limb length discrepancies and deformities with different causes including:

Trauma, including growth plate fractures, malunion (where the bones heal crooked), nonunion (where bone heals incompletely), shortening and deformity due to bone loss.

Congenital limb length discrepancies. These conditions are associated with many birth defects and deformities including short femur, fibular hemimelia, pseudoarthrosis and hemiatrophy.

Short stature including **achondroplasia and other skeletal dysplasias and constitutional short stature.** External fixators are effective in treating limb length discrepancies linked to dwarfism. Treatment may be appropriate in some cases in order to allow the patient to function more independently.

Infection involving the bone (osteomyelitis) and joint (septic arthritis). Treatment of bone infection often requires removal of bone segments which may result in angular deformities and limb length discrepancies.

Developmental causes which are related to the slowing of growth and **limb deformities caused by illness such as Blount's Disease**, which typically affects the bone development of overweight toddlers and adolescents.

External fixators are also used in the treatment of **pediatric hip disorders** such as Developmental Coxa Vara (DCV), Perthes disease and Slipped Capital Femoral Epiphyses (SCFE).

Joint stiffness following injury, infection or other causes can sometimes be addressed by controlled joint distraction (arthrodiastasis), with the use of external fixators.

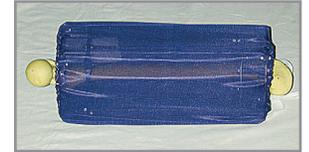
Soft tissue scarring such as after burns and multiple surgeries for club foot correction can be addressed with gradual distraction techniques.

Underwear (Haines, 2000)

- Must have a wide leg diameter.
- Must be very stretchy.
- Can be split in the seam, and snaps or hooks and loops can be added.

Covers for External Fixators

- TAYLOR SPATIAL FRAME® or ILIZAROV™ covers
- Double-thickness stockinettes
- Be creative and make your own cover.



Purpose of Covers

- Provide warmth for comfort and circulation purposes.
- Provide protection from dust, dirt and grime.
- Prevent tears in clothing and sheets.
- Prevent damage to furniture.



Clothing Modifications

Purpose (Haines, 2000)

- Hide the frame.
- Provide warmth during winter months.
- Provide ventilation during summer months.
- Provide a protective shield, preventing dust, dirt and grime from invading the pin sites.

Clothing for Men and Women (Haines, 2000)

- Snap-on nylon sports pants or shorts may be the most comfortable articles of clothing to wear. Some snap all the way up to the waistband making them easy to get on and off.
- Trousers can be altered by cutting the inside and/or outside seams up to the crotch and inserting triangular pieces of fabric.
- Secure the fabric inserts with hooks and loops by sewing machine or by placing buttons.
- Select trousers with many pockets for carrying around small items.
- During the summer months you may wish to wear shorts or cut off the pant leg above the external fixator.
- For women, loose-fitting dresses, skirts or shirts are preferable.

Shoes (Haines, 2000)

- Wear shoes that are comfortable, protect your toes, allow for balance, support and stability and keep the feet warm.
- Sneakers are recommended.
- If the external fixation device covers a portion of the foot, you will need to modify your shoes.
- If the fixator includes the foot, a foot ring with a rubber sole can be added instead of a shoe.

TAYLOR SPATIAL FRAME[◇]

The TAYLOR SPATIAL FRAME is a unique external fixation device used to treat a variety of bone fractures and deformities. The device consists of two rings connected by six telescopic struts extending from and to special universal joints located on the rings.

The device fits around the patient's limb and is attached to the bone with pins that extend from the rings through the skin and into the bone. By making daily adjustments to the lengths of the six struts, one ring can be repositioned with respect to the other, resulting in the ability to correct even the most complex bone deformities and fractures.

Using a web-based application, your surgeon is able to enter the original deformity data into the program through standard web devices such as "radio buttons" and "text boxes." Based on the data entered, the software provides the surgeon with a day-to-day prescription of strut adjustments needed to correct the bone deformity.

The software is capable of producing graphic representations of the deformity at any point during the prescribed schedule. As a result, your surgeon is able to conduct a side-by-side analysis between your x-ray and the graphic produced by the program in order to ensure the deformity is healing correctly and in the projected amount of time.

Your Core Team

Learning about the mechanics and biology of limb correction can be overwhelming. It is important to know that you will have a great deal of support and guidance throughout this process. From day one, you will have a team of specialists and loved ones who are committed to your successful recovery. Since you have been chosen as a candidate for limb correction, you should know that your orthopedic surgeon already has confidence in your potential for success. Together, you will set a realistic lengthening or straightening goal so you will know what to expect at the end of the process. It's the mission of your team to work together to assist in achieving this goal. As you meet each member of your team, write down his or her name and telephone number so you can call on him or her for support when needed.

You

You are the most crucial team member because your active participation is valuable to the success of the limb correction process. You will be required to assist with fixator adjustments, as instructed. Without your commitment to goals, and your important feedback along the way, other team members cannot operate as effectively in their roles.



Pin-Tract Infections

- Call your doctor if you experience (NAON, 1999):
- Redness, warmth and swelling from the pin sites. A small amount of redness is normal.
- Extremely tender pin sites.
- Persistent fever of 100.5 degrees or higher Fahrenheit, taken orally.
- Thick, cloudy, white, yellow or green drainage from pin sites. (Clear yellow or slightly bloody drainage is normal.)
- Odor at the pin sites.

These are warning signs of infection. Call the clinic promptly. Early treatment is mandatory.

Oral antibiotics and increased pin-site care may be needed to keep the infection from spreading further.

Nerve Problems

The first sign of a nerve problem is called “referred pain.” This is pain in the foot that occurs during the lengthening phase. The pain is in a location where there are no pin sites (usually the top of the foot). The next sign is increased or decreased feeling in the area of the foot. Report these to your physician as soon as possible. They may be symptoms of nerve irritation.

Showers

Cleaning the pin sites with an antibacterial liquid soap and water while taking a shower has proven to be a simple and effective pin-care method. As long as there are no open wounds and your physician allows it, you can shower with the TAYLOR SPATIAL FRAME° in place. Patients are encouraged to wash the frame as well as the leg in the shower using the liquid antibacterial soap. Allow the soap and water to run down the extremity. Do not scrub. Rinse and dry the fixator and the extremity thoroughly. Dry using a hair dryer on cool setting.

Any activities that involve soaking the external fixator in potentially contaminated water are discouraged. Your doctor may allow you to swim in a clean, chlorinated pool – no natural ocean waters, rivers, etc. For safety purposes consider placing a rubber mat in the tub, using a shower chair, and installing handrails in your shower.

Significant Other

It is important that a parent, sibling, spouse or close friend (someone dedicated to your well-being) be involved in the process from the beginning. They need to understand the procedure as well as you do, and they need to participate in the process of planning.

Orthopaedic Surgeon

Unlike some areas of medicine, limb correction requires that your surgeon be involved in every phase of the process. He or she makes the initial evaluation, performs the operation to apply the TAYLOR SPATIAL FRAME°, plans your recovery goal and closely follows your progress. The surgeon may have an orthopedic resident, nurse or physician's assistant specifically trained to help with the surgery, and frame construction and modification.

Clinic Nursing Staff

Your clinic nurses coordinate the work of the entire team through each phase of your treatment. Your nurse is often the first person to answer questions, listen to concerns and advise you about problems as they arise.

Therapist

Your physical therapist or occupational therapist conducts a pre-op assessment of your movement ability and works with you throughout the process to help you stay as active and independent as possible.

Home Care Discharge Planner

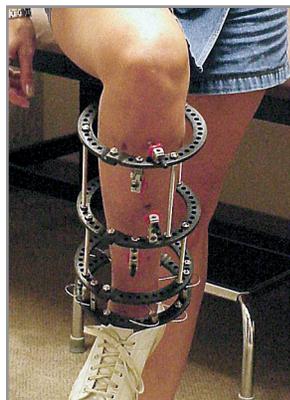
Surgery can be a difficult and emotional time. A home care discharge planner is available before and after your surgery to talk about your concerns. They also can help you solve logistical problems: transportation, temporary housing and the rental of medical equipment such as wheelchairs and crutches.

Understanding the Process

There are two main phases to the correction process: correction/lengthening and consolidation.

The initial correction phase is the time needed to gradually achieve the desired correction/length of the limb. The following consolidation phase is needed for the new bone tissue to harden and mature. Each individual's body is different, but the total time of wearing the fixator is typically four to 12 months.

Lengthening refers to the period of time it takes to "grow the bone." This lengthening phase begins after the surgeon cuts the bone and attaches the TAYLOR SPATIAL FRAME[®]. During this time you will be working with the physician and your team to make gradual adjustments to the device, which increases the gap between the bone segments, adding "length" to the total limb. Over a period of months, new bone tissue will grow in the gap, ultimately hardening the area between the segments of the original bone.



Pin Care

Skin infection is a common problem around pin sites but may be avoided with proper pin care. A major responsibility that you perform as a team member is making sure the areas of pin sites and wires is cleaned daily.

You may not be allowed to shower for approximately five to seven days after placement of the external fixation device. If you have an incision, you may not be able to shower until the stitches or staples are removed. Until you are able to shower, your surgeon may have you clean the pin sites with cotton swabs and normal saline. During the first few days after the application of the external fixator, expect clear yellow or slightly bloody drainage from the pin sites. To remove this drainage, saturate a cotton swab in normal saline. Start at the pin site and move outward, using a circular motion. Each cotton swab should be used only once and then thrown away. Cotton swabs also may be utilized to remove dried blood and scabs from the pin sites and keep the skin from adhering to the pins (NAON, 1999). Be careful not to irritate the skin. Excessive skin motion on the pin may cause infection (Schwartzman, 2000). If you have difficulty reaching or seeing all the pin sites, ask a family member or friend to help you or you can use a mirror (Haines, 2000).

The above method is one of many ways to care for pins and wires. Be sure to follow your physician's instructions for pin care.

Dealing with the Stress of External Fixation

- Know that the discomfort associated with the device is usually mild.
- Anticipate early mobility.
- Keep a good attitude and sense of humor.
- Know that the device is temporary.
- Think about the vastly improved quality of life you will have at the end of your treatment.
- Actively participate in your care associated with the fixator.
- Normal activities of daily living may be more time consuming. Allow enough time for these activities to avoid frustration.
- Keep active. Go to the movies, go out to eat, attend football and baseball games, and visit with family and friends (Haines, 2000).
- Keep your mind busy by reading books, listening to music, exercising, relaxing, crossword puzzles, etc. (Haines, 2000).
- Seek psychological counseling if needed (Haines, 2000).
- Your surgeon can order an antidepressant (Elavil) if you experience difficulty with sleep, appetite and mood.



When your physician is satisfied with the length and position of the new bone, the consolidation phase begins. During this phase, the bone tissue matures and becomes solid. You still wear the spatial frame, but you will not make adjustments. The consolidation phase is the longest part of the ILIZAROV™ process. It takes twice as long for the bone to harden as it does to lengthen it, so the consolidation phase typically doubles the time spent in the lengthening phase.

Just reading about this complex process is not enough to fully prepare you for the experience, which can take up to a year of your life. One of the best ways to understand the process is to speak with someone who has gone through limb correction. Ask your physician or staff member to introduce you to someone who would be willing to talk about their experience and help you prepare for this temporary “lifestyle.” Take the time to jot down some notes, which you can use later for comparison, when your correction is in progress.



Planning for the Journey

As other TAYLOR SPATIAL FRAME® patients will no doubt tell you, the limb correction process takes a great deal of preparation as well as personal commitment. Your physician will want you to stay physically active while you are wearing the frame. It is important to maintain as many daily routines as possible and continue attending school, work, church and social activities. This will require planning. To prepare yourself and your family for this new lifestyle, quite a few issues need to be considered. Make sure you work with your physician and other team members in the planning process.

Hospitalization

You should plan for a hospital stay of three to four days. Ask your team for help in planning what to bring with you and providing other information about your hospital stay.



The first few days after surgery, it is likely that you will feel considerable pain or discomfort. Your physician has planned for this and will administer pain medication as needed. You may receive pain medicine intravenously for the first couple of days. After your discharge from the hospital an over-the-counter pain medication, like acetaminophen, may suffice but in some cases a narcotic may be needed. Avoid using over-the-counter anti-inflammatory medications for pain control. These drugs decrease the bone healing rate by reducing the inflammation that is necessary for the process of bone formation (Schwartzman, 2000). Pain medicines should be taken before therapy and at bedtime as needed for your comfort. Whatever the degree of your pain, it should get progressively less bothersome.

Ways to Alleviate Pain

- Do your exercises. Do not allow your knee or ankle to become stiff.
- Keep the pin sites clean.
- Elevate the affected extremity while at rest, securing position and proper alignment to decrease pain and swelling.
- Take pain medication at least 30 minutes prior to exercise to facilitate easier movement with less discomfort.
- Practice relaxation, distraction and imagery techniques to calm yourself and relax your muscles.
- Contact your physician promptly if you experience increased pain, discomfort or swelling unrelieved by rest.

Coping with Pain

Pain management is essential to your well-being and recovery. Pain may decrease your desire and ability to walk and actively participate in physical therapy. Pain also may cause the adoption of protective postures, such as keeping your knee bent or your foot extended, which may lead to joint stiffness and decreased joint mobility (Parihar, 1998). Although the bone transportation itself should not be painful, poor pin care may cause the skin around the pin sites to become taut, causing pain at the level of the skin (Schwartzman, 2000).



Your attitude throughout the ILIZAROV™ process is important to its success. This means you will have to find ways to cope with discomfort, pain and frustration, plus the natural ups and downs of your emotions during this long process. Whenever possible, tell your physician or nurse what is troubling you, and be prepared to experience some degree of pain from the beginning. It should, however, always be manageable. Each individual experiences pain differently so it is difficult for medical professionals to discuss norms. (Remember this when you are talking to other patients.)

Fixator Adjustments

Make the commitment now to follow a schedule of fixator adjustments, which are usually needed approximately every six hours.

Scheduling Considerations

Plan ahead for the amount of time away from school or work, frequency of office visits, time of year and transportation issues.

Physical Limitations

Understand ahead of time what you can and cannot do.

Changes to Normal Activities

More time, preparation, energy and rest will be needed to perform daily activities. See the Activities of Daily Living section at the end of this brochure for more details. Your team also might provide further information.

Clothing Adaptations

Make arrangements to wear loose clothing, which will fit over the fixator. See the Clothing Modifications section of this brochure for more information.

Insurance Coverage

Know your plan and make sure to secure all approvals prior to surgery. Check to see what they cover for medical equipment. Your physician's office may be able to assist you with this.

Household Furniture and Linens

Your furniture and linens can be protected from damage caused by the fixator by wearing a protective covering over it.

Clinic Visits

As part of the planning process, you need to understand the amount of time needed for follow-up office visits. Be sure to discuss this with the team member who is helping you with the logistics of these visits.

During the lengthening phase, you may visit the clinic every two weeks so the team can keep a close watch on how you are progressing. This is also an opportunity to meet other TAYLOR SPATIAL FRAME[®] patients and receive support during these early weeks. During the consolidation phase you may visit the clinic once a month.

Follow-up visits may involve (Parihar, 1998)

- Measuring the distraction amounts since your last visit.
- Assessing range of motion of the joints above and below the frame for contractures. Contractures occur when the joint is not exercised. Without exercise the tendons and muscles shorten causing joint deformity, stiffness, limited mobility and pain (Smeltzer, 230-232).
- Checking the pin sites for inflammation/infection.
- Checking the frame for loose wires, nuts and bolts.
- Taking X-rays to check the rate and progress of the lengthening and assess the quality of the new bone.

Afterward, you will meet with other team members as needed. Office visits may range from 30 minutes to two hours, depending on what work needs to be done.

Support Yourself

Although you will have a great deal of support available to you during the process, you are your own strongest support system. Your most important job is to take care of yourself.

Nutrition

Attention to nutrition is an important way to assure the speedy healing of new bone as well as keep the rest of your body in good shape for the extra physical and emotional demands. A well-balanced diet with adequate protein, minerals and vitamins is needed for healthy tissue-and-wound healing. A dietician can instruct you and your family about diet and can answer general nutrition questions. Your physician may prescribe calcium supplements as well. Throughout the process, avoid drinking colas and other drinks, which contain excessive phosphoric acid. They may decrease the amount of calcium the body absorbs.

Weight

When walking with crutches, you do not want any extra body weight because it will make you tired quicker, leading to a decreased amount of exercise. Your physician may suggest a weight-control diet to help you achieve and maintain your ideal weight.

Stop Smoking

Avoid smoking (even secondary smoke). The nicotine in cigarettes interferes with bone formation and harms the body's ability to heal. Nicotine patches cannot be worn because they produce the same bad effect (Schwartzman, 2000).



Physical Therapy

Within several days of your surgery, you will begin a thorough and on-going rehabilitation program designed to improve blood supply to the limb and promote healing. If you are having a leg lengthened or straightened, you will participate in physical therapy in the hospital until you begin to walk. Your physical therapist may teach you exercises to help you develop sitting and standing balance, stability, and coordination to prepare you for mobilization and ambulation (Smeltzer, 230-232). If you have had an arm deformity corrected, therapy will be continued until you are able to use the arm for a range of daily care. This usually takes three to four days. Your therapist will prepare a home-exercise program designed to maintain the limb's range of motion and strength. Their objective is to help you become as independent as possible in your personal care and daily activities. Aerobic activity increases blood flow and strengthens bones. It burns calories, increases resistance to disease and decreases tension. It also releases endorphins – the body's own pain-control system.

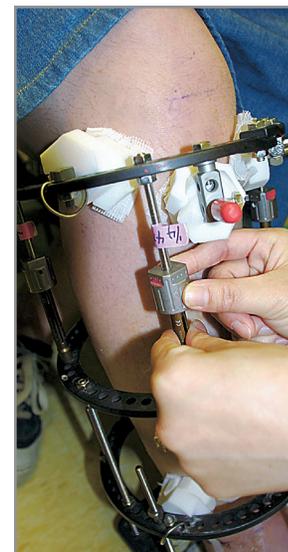


Safety

- Make sure your crutches have large rubber suction tips (Smeltzer, 230-232).
- Good balance and erect posture are essential for crutch walking. Learn to balance by standing next to a chair on the unaffected leg. Wear well-fitting shoes with firm soles to prevent falls (Smeltzer, 230-232).
- Stay away from wet, slippery surfaces, freshly waxed floors, and rough, uneven surfaces (Haines, 2000).
- Going up and down stairs requires both strength and flexibility. Make sure someone is by your side until you have regained your strength and mobility.
- To go up and down stairs remember – up with the good leg, down with the affected leg.

Adjusting the Fixator at Home

If you are having a limb lengthened or corrected, you will be required to assist in the process by making frame adjustments at home. This is usually done every six hours. Your physician will make sure that you are trained and understand how to make adjustments. You also will receive a specific “turning” schedule at each clinic visit. There may be a time when you experience some failure of the mechanics of the device, such as broken wires or bent rods. And there may be times when you are unable to turn the “strut.” If this happens, call your clinic promptly.



Ambulation with Crutches

Before walking with crutches, it is imperative that you are fit properly for them and that you know how to ambulate correctly and safely. Your physician will prescribe a weight-bearing status for you, which will be partial weight bearing or full weight bearing. Your physical therapist will teach you techniques for standing, walking and maneuvering yourself with crutches. With a little time, practice and patience, you will learn how to walk with crutches.

Comfort

- Crutches should be custom adjusted to your body size by your physical therapist.
- Make sure you have a thick foam rubber pad on the underarm piece to relieve pressure of the crutch on the upper arm and thoracic cage. Never put pressure in the axilla (armpit) when using crutches (Schoen, 2000).
- Weight should be supported on the hand pieces to avoid damage to the nerves under the armpits (brachial plexus nerves), which can cause “crutch paralysis” (Schoen, 2000).
- Crutch walking can take a toll on the hands. Protect your hands from pain and calluses by using hand-piece pads in good condition.
- Long-term crutch users may benefit from new shock absorbing crutches.
- If you are getting numbness in the hands, get your therapist to check your crutch length and proper crutch use. Ask about Canadian Crutches.
- Keep your body weight down.



Your exercise program is your doctor's prescription. The exercise program designed for you will depend on the type of injury sustained. To avoid complications, it should be followed with commitment and discipline. You may be able to walk, ride a stationary exercise bicycle and swim in a chlorinated pool (after your sutures are out). You must bear weight on the affected extremity or you may not heal properly. Putting weight on the affected extremity promotes healing (Schwartzman, 2000). Whatever the method, exercise is critical for a speedy recovery. Check with your physician or physical therapist for specific instructions.

During your recovery process, you will be expected to schedule periodic visits with your physical therapist so your progress can be monitored and adjusted to meet your body's changing needs.

Exercises

Listed on the following pages are some exercises that your physician may have your physical therapist teach you. However, these exercises may not be allowed immediately. You can learn the exercises using the unaffected leg (Schoen, 2000). **Do only with the advice and supervision of your physician and physical therapist.**

Arms and Hands

Flexion and extension exercises for the arms and forearms with the use of weights strengthen the shoulder and upper extremity muscles to prepare you specifically for crutch walking (Schoen, 2000).

Flexion: The arm is bent.

Extension: The arm is straight.

Push-ups help strengthen the arms for crutch walking. These can be done from a sitting position or while lying on your stomach. Use your hands to raise your body from the chair seat, mattress or floor (Smeltzer, 230-232). Squeezing a rubber ball strengthens the hands for crutch walking (Smeltzer, 230-232).

Unaffected Extremities

Active and passive range-of-motion (ROM) exercises for the unaffected extremities will keep these muscles strong. These muscles need to be strong enough to withstand the extra stress placed on them. ROM exercises consist of straightening and bending one or more joints of the body and moving them in all the directions they normally move.

Active ROM: exercises you do yourself, with or without the supervision of the physical therapist.

Passive ROM: exercises performed by the physical therapist without any effort from you.

Affected Extremity

Exercises the surgeon may prescribe for the affected extremity include quadriceps and gluteal-sitting exercises, ankle pumps and straight-leg raises (Schoen, 2000).

Quadriceps-sitting exercises help prevent contractures of the knee. It may be more comfortable to sit or lie with your leg bent than it is to keep it straight, but prolonged periods of sitting or lying with your knee bent can cause joint stiffness and limited mobility. To perform quadriceps-sitting exercises you must first lie on your back. Next, elevate the affected extremity by placing a pillow under the heel of your foot so that the knee is straight. Start the exercises by tightening the thigh muscles so that the knee is pushed downward (Haines, 2000). Hold for a count of five. Slowly release. Perform this exercise at least 10-15 times every hour while awake.

Gluteal-sitting exercises increase circulation and strengthen the muscles of the buttocks used for ambulation (Schoen, 2000). To perform this exercise, squeeze your buttocks together. Hold for a count of five. Slowly release. Perform this exercise at least 10-15 times every hour while awake.

Ankle pumps help increase circulation, and prevent blood clots, and contractures of the foot and ankle. To perform ankle pumps pretend that you are pressing on the gas pedal of a car and releasing. Perform these often.

Straight-leg exercises are done to help build muscle strength in the affected and unaffected leg. Lie on your back. Place a pillow under the heel of the affected leg. Keeping your leg straight, lift your leg until the count of five. Slowly lower. Repeat until the thigh feels fatigued. Follow the same protocol for the unaffected leg, except do not elevate it on a pillow. Start with it flat on the floor.