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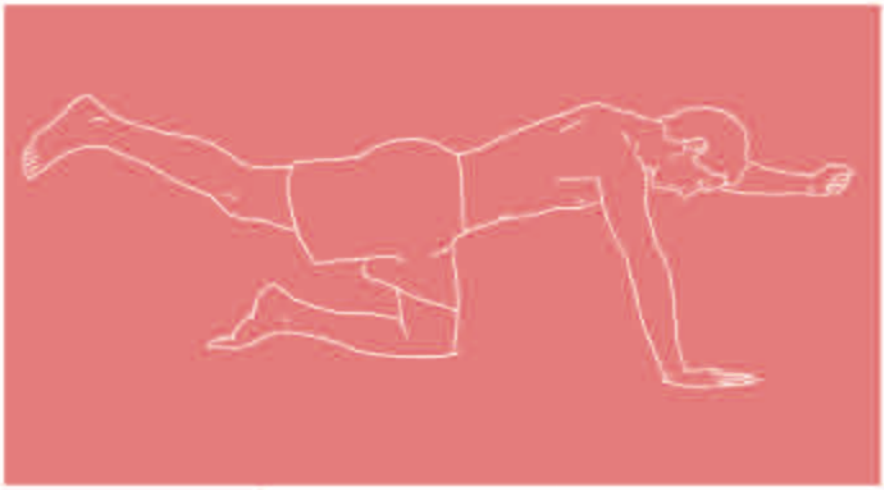

Exercises for People with Hemophilia

by Kathy Mulder

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Table of Contents

Introduction

The question sounds simple enough: "I have hemophilia. What kinds of exercises should I do?" Or, "What exercises should I give my patients with hemophilia?" The answer is simple too: "It depends."

There is no such thing as "exercises for hemophilia." Different exercises serve different purposes and "each person's situation" is unique. Exercise, like medicine, works best when there has been a complete assessment done by a trained professional, and specific exercises have been chosen that suit the "individual's goals and ability."

This guide is intended for:

- physical therapists with little experience working with people with bleeding disorders;
- other healthcare workers, such as community rehabilitation workers and physical therapy assistants working in areas where a physical therapist is not always available; and
- people with hemophilia and their families.

Section 1 – How Joints and Muscles are Affected by Hemophilia provides a description of common muscle and joint bleeds and how particular muscles and joints react to bleeds over the long term. **Physical therapists who have little experience with treating people with hemophilia should read this section first.**

Section 2 – A Few Words About Exercise and Hemophilia provides some important "dos and don'ts" for physical therapists and people with hemophilia.

The subsequent sections provide a description of exercises that aim to counteract the long-term effects of joint and muscle bleeding and the tendency to develop abnormal postures. These are by no means the only exercises that can be used, but they have been selected for specific goals and because they are relatively safe to do with minimal equipment and little supervision. The exercises can be photocopied and distributed to patients by physical therapists. At the beginning of each section is a description of the anatomy and the frequent problems related to that part of the body.

Section 3 – Suggested Joint Exercises provides exercise progressions for the knee, ankle, and elbow joints, focusing on range of motion, strength, and proprioception.

Section 4 – Suggested Muscles Exercises provides exercise progressions to strengthen or lengthen muscles that have become tight due to bleeding or in response to joint bleeds. Exercises for each muscle have been chosen that will restore length (flexibility) and muscle strength. The exercises focus on the following muscles: iliopsoas (hip flexor), gastrocnemius (calf), hamstrings, forearm flexors, and quadriceps.

A **Glossary of Terms** can be found at the back, with definitions for the words that appear in bold text throughout the guide.

The exercises in this guide are not the only exercises useful for people with hemophilia. They have been chosen to meet specific goals, and because they are relatively safe to do with minimal equipment and supervision. The "right" exercise for each individual depends on many things:

- What is the goal of the exercise program? Different exercises are selected depending on whether there is a need to improve mobility, strength and/or coordination, cardiovascular fitness, or ability in simple activities or sports.
- Has there been a recent bleed?
- Is there a **target joint?**
- Is there a deformity or some joint damage that has been present for a long time?

- Is there pain at rest?
- Is there pain or **crepitus** with movement?
- Are there particular activities that are difficult or painful, such as rising from a chair, climbing stairs, squatting, or kneeling?
- Has this person done exercises before or is he just starting?
- Does this person see the need to do the exercises, or is it someone else's idea?
- Is this person able to understand and follow detailed instructions?
- Is factor available for **prophylaxis** or in case of an injury?

There are hundreds of books, videos, and television shows that feature celebrities making all sorts of promises about their exercise programs. Some people with hemophilia may be tempted to try these programs since they are told that exercise is good for people with hemophilia. In other situations, exercises are "prescribed" by practitioners who have no training in exercise selection. Both of these approaches can be frustrating and unsuccessful at best, and in the worst-case scenarios can cause further damage.

One exercise program does not meet the needs of all people with hemophilia. The wrong exercise, an exercise done incorrectly, an exercise done at the wrong time in the recovery stage, or an exercise done at the wrong frequency or intensity can cause harm.

Some people with hemophilia avoid exercise because they think it may cause bleeds, but regular physical activity can actually help prevent bleeds and joint damage. Exercise is important for building healthy bones and strengthening the muscles that support joints.

Ideally, exercises should be prescribed for people with hemophilia by a skilled and patient **physical therapist** following a detailed assessment. The exercise program should then be supervised and advanced carefully by the same physical therapist. However, this is not always possible for many reasons:

- Not all physical therapists are familiar with hemophilia and its effects on joints and muscles;
- Comprehensive hemophilia treatment centres (HTCs) do not exist in all countries;
- Even when HTCs do exist, individuals with hemophilia may see the HTC physical therapist only infrequently (for example, at the annual assessment). Interim communication is done by phone, fax, or wireless communication devices. Assessment and the assignment of exercises are done remotely instead of face to face;
- Individuals with hemophilia and/or nurses and physicians may not be aware of all that **physical therapy** can offer, and the physical therapist is not consulted for an opinion;
- In smaller or more remote communities, there may be no physical therapist available.

This guide should be used:

- at annual assessment clinic visits with the HTC physical therapist (exercises should be reviewed to ensure that they are still appropriate for the individual);
- for rehabilitation during recovery from bleeds, especially if the patient lives far away from the HTC (the physical therapist can prescribe exercises by phone or e-mail based on patient descriptions of their status); and
- in the home, as a reference to ensure that the exercises are being done correctly.

Exercise is a good thing. Too much rest is not good for anyone, and the right amount of activity, whether physical or mental, is very beneficial. Adults must "use it or lose it" and children must "learn how to use it."

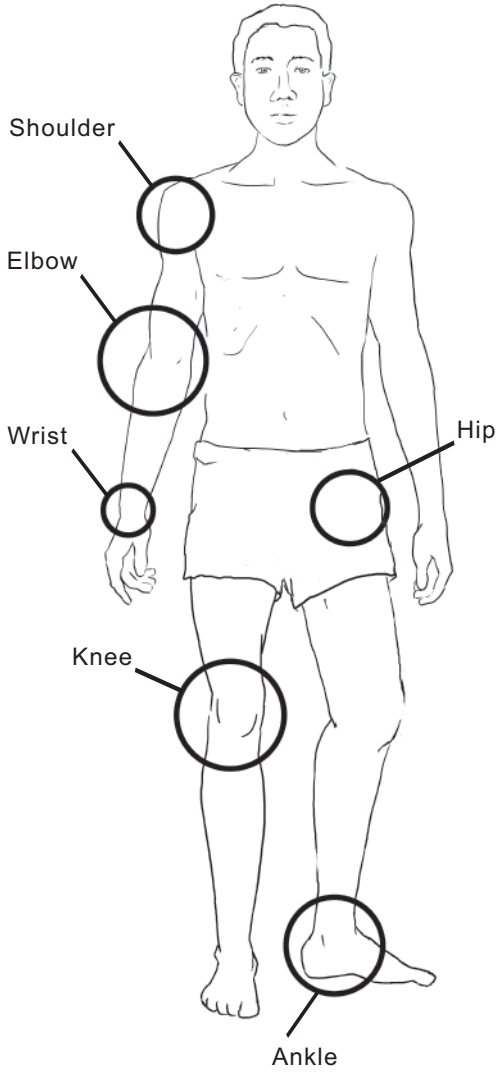
Section 1: How Joints and Muscles are Affected by Hemophilia

The knees, ankles, and elbows are more commonly affected by hemophilic bleeding than other joints. This is attributed to two main reasons.

First, these joints have one degree of freedom of movement — as simple hinge joints, they can only flex and extend. Joints such as the hip and the shoulder, however, have multiple degrees of freedom of movement and can move around in many directions without strain. These ball and socket joints are not affected by bleeds as often as the hinge joints.

Second, the hinge joints are not surrounded by protective muscles, whereas the hip and shoulder joints are covered by many layers of strong muscles. The muscles of the knees, ankles, and elbows are situated above and below the joints and in most cases only the tendons cross over the actual joints. Therefore, the joints are not as well protected on all sides.

Figure 1: Joints Affected by Hemophilic Bleeding



It is also understood that different muscle groups react differently to injury. Muscles function as either "stabilizers" or "mobilizers." Stabilizer muscles provide stability to the body and limbs. They work constantly to hold the body up against gravity, or allow the body to remain still while we superimpose a movement. They are made up mainly of muscle fibre types that do not fatigue quickly. Mobilizer muscles produce movement and work only when they are needed to perform a particular task. These muscles work in short bursts and are made up mainly of muscle fibre types that fatigue quickly.

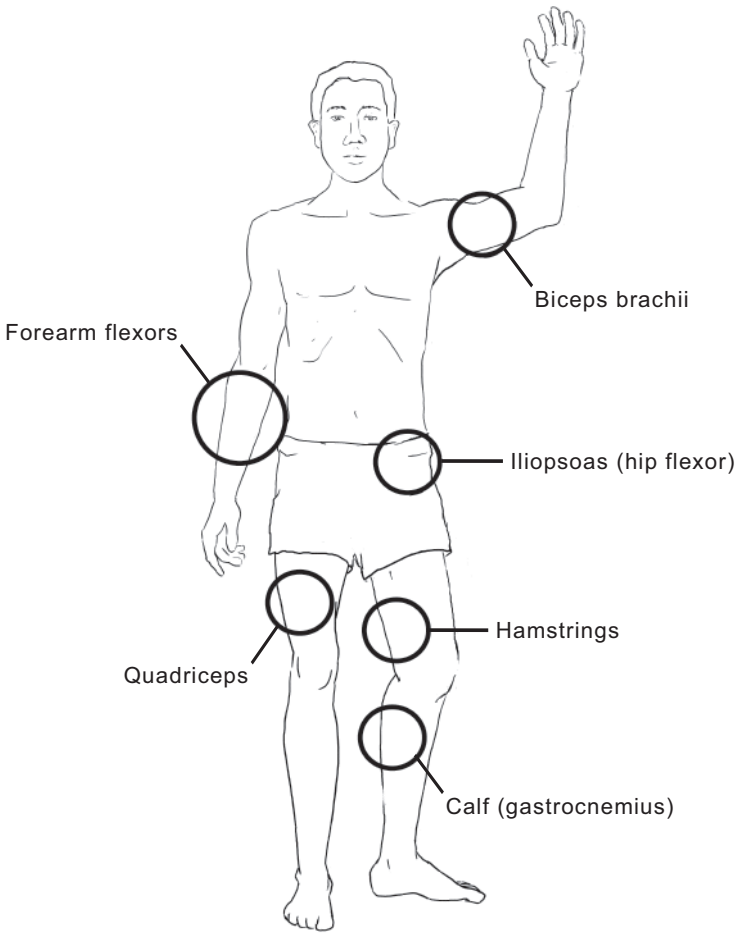
Stabilizer muscles are usually deep muscles, located near the joints. When there is an injury in the area, they react by becoming weaker. The nearby mobilizer muscles are then called on to take over the stabilizing function. Because they fatigue quickly, mobilizer muscles cannot perform as the stabilizer muscles do. The mobilizer muscles then become tight and painful and are easily injured if they are stretched or overworked.

Muscles that react by tightening include the **flexor** muscles of the wrist and fingers, calf muscles, hamstrings, and hip flexor muscles (iliopsoas). Figure 2 shows that these are also the common sites of muscle bleeding in people with hemophilia.

Muscles that react by weakening include the quadriceps, triceps, and hip **extensor** muscles. Over time, the weak muscles become weaker and the tight muscles become tighter.

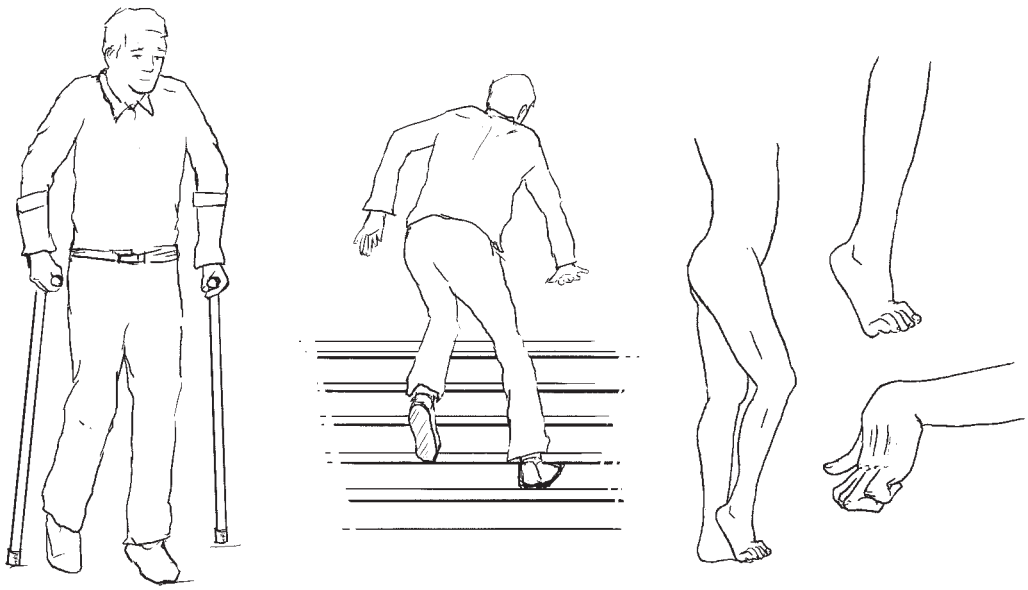
This is why a proper assessment of muscle function is so very important before an exercise program is selected. The right muscles must be trained in the right way or the situation can be made worse.

Figure 2: Muscles Affected by Hemophilic Bleeding



People with hemophilia who have had many bleeds tend to develop a distinctive posture that may include: **flexion** deformities of the elbows, knees, and hips; an exaggerated arch in the back **(lumbar lordosis); plantarflexed** ankles; pelvic asymmetry due to leg length differences; and varying amounts of muscle wasting (Figure 3). Flexed wrist and fingers caused by deep forearm bleeds are less common, but very dramatic.

Figure 3: Possible Flexion Deformities Due to Hemophilic Bleeding



A distinctive posture develops in predictable patterns according to the positions that joints and muscles prefer when there is a bleed in the area. These are summarized in Table 1 – Development of Abnormal Posture Following Bleeds.

Unless there is a conscientious and sustained attempt to restore full joint motion, muscle flexibility, and muscle strength, this posture can become typical for the individual and the weak muscles continue to weaken and the tight muscles become even tighter.

"My child started to do some exercises to strengthen his left ankle which was bleeding occasionally. His physiotherapy program included picking up little objects (like a pencil) with his foot (which amused him a lot), and exercises in the water. His body awareness increased with the regular exercises and he steps firmly now."
– Mother of a five-year-old child with hemophilia B, Brazil

"The exercise in physical therapy is a necessity for the hemophilia patient. It strengthens the muscles and releases the joints. From my experience, I began my rehabilitation when I was wheelchair bound. With much effort, I slowly began to walk with the help of a walker. Hydrotherapy also helped me by leaps and bounds."
– 53-year-old with severe hemophilia A, Israel

Table 1: Development of Abnormal Posture Following Bleeds

Physical therapists should use the following table to become familiar with the movement restrictions and adaptive postures that are seen frequently with hemophilia. With this knowledge, physical therapists can help patients prevent these changes from becoming permanent.

Joint bleeds	Position of comfort	Habitual posture	Potential problems
Knee	Flexion	Walking on flexed knee, with hip flexed and/or ankle plantarflexed to compensate	Pain in patellofemoral joint; stress on ankle; overuse of hamstrings; weak quadriceps
Elbow	Flexion	Loss of elbow extension, arm may be carried with shoulder extended	Eventual difficulty with forward elevation of the arm
Ankle	Plantarflexion	Walking on toes, with knee and/or hip flexed to compensate	Ankle in unstable position, with small area of weight-bearing on talus and sole of foot; overuse of calf muscles; pressure on knee
Hip (unusual site)	Flexion, external rotation	Hip flexed, increased lumbar lordosis, compensatory knee flexion	Incomplete hip extension during gait; compensation with increased rotation of pelvis or spine
Shoulder	Adduction, internal rotation	Arm held close to body	Difficulty with activities related to daily living and self-care
Wrist and fingers	Flexion	Wrist flexed, hand closed	Difficulty extending wrist and fingers; inefficient grip
Toes	Extension (dorsiflexion)	Extension (dorsiflexion)	Difficulty wearing shoes
Muscle bleeds	**Position of comfort**	**Habitual posture**	**Potential problems**
Hamstrings	Knee flexion, hip extension	Knee flexed	Altered gait; knee flexed, walking on toes
Biceps brachii	Elbow flexion, shoulder internal rotation	Elbow flexed	Incomplete elbow extension; decreased protective balance reactions
Calf (gastrocnemius)	Ankle plantarflexion, knee flexion	Ankle plantarflexed, knee flexed	Walking on toes, knee flexed; stress on knee and ankle joints
Hip flexor (iliopsoas)	Hip flexion, some external rotation and increased lumbar lordosis	Hip flexed, extreme lordosis, walking on toes	Back pain; incomplete hip extension; stress on knee and ankle
Wrist and finger flexors	Wrist and finger flexion, elbow flexion	Wrist and finger flexion, elbow flexion	Inability to open hand; weak grip due to incomplete wrist extension
Thigh (quadriceps)	Knee extension	Knee remains extended	Incomplete knee flexion; risk of re-injury with sudden knee flexion; functional difficulties on stairs, squatting, etc.
Hip extensors	Hip extension	Hip extension	Unable to sit
Wrist and finger extensors	Wrist and finger extension, elbow flexion	Wrist and finger extension, elbow flexion	Unable to grasp

Section 2: A Few Words About Exercise and Hemophilia

No factor? No problem.
Many people are afraid to try exercises or to prescribe all but the most basic exercises if factor (clotting factor concentrate, cryoprecipitate, plasma) is not readily available. They are concerned that exercise may cause bleeding. The exercises in this guide are arranged in levels of difficulty from least difficult to more strenous. The most strenuous exercises are identified clearly, and instructions are provided on how to work up to these more difficult levels safely. If the principles and warnings given in the guide are observed, lack of treatment products should not deter people from beginning an exercise program. By the same token, access to treatment products does not mean that people should begin at a level that is too difficult.

Slow and steady.
As they learn new exercises, adolescents often want to show off how much they can do and may over exert themselves without realizing it. It is very important to begin slowly and progress gradually.

Don't underestimate isometric exercises.
Isometric exercises involve contracting a muscle without producing movement at the joint. Isometrics are an excellent way to begin exercising if muscles are very weak, or if joints are very painful with movement.

No gain with pain.
Pain is usually a sign that something is wrong. People with hemophilia must learn to listen to their bodies, and physical therapists must listen to what they say. If a new pain begins during exercising, it is very important that it be analysed carefully: Is this muscle fatigue, or the sign of a new bleed? Is the exercise placing too much strain on a damaged joint?

It is not uncommon for physical therapists to exhort patients to do "just a few more" exercises. Many people with hemophilia tell stories of times when "the physical therapist made me have a bleed." If the person with hemophilia says he has done enough exercises or repetitions, it is wise to believe him.

Each situation is unique.
The number of exercises and repetitions depends on the situation of each individual. If it is very soon after a bleed, two or three repetitions may be all that can be tolerated. If the bleed has stopped and the aim is to restore lost range of motion, more repetitions may be needed. The individual and the therapist must listen to the signals from the body — discomfort usually means enough for that session.

The number of repetitions will also depend on which type of muscle is being exercised. The stabilizer muscles need to be able to work repeatedly and for long periods; they should be trained with low resistance but many repetitions.

Use gravity and body weight as resistance to start.
Sometimes, the simplest exercises are quite adequate. Membership at the gym or investment in exercise equipment is not necessary. In fact, using exercise apparatus may be difficult for someone with arthropathy or someone who is recovering from a bleed. Start with simple, practical, functional exercises, and allow the individual to progress.

Think about the other joints.
Some of the exercises designed to help one joint may place too much stress on other joints. For example, weight-bearing exercises to strengthen a knee may be difficult and ill advised if the ankle on the same leg is damaged.

Remember functional requirements.
Consider the different functions the individual needs to be able to do. The exercises for someone having trouble getting on and off a chair will be different than for someone having trouble running. Furthermore, compliance with any exercise program will be increased by choosing exercises that relate to the individual's functional goals.

Don't forget proprioception.
Proprioception is the process by which the body reacts to changes in joint position. The joint position receptors are located in the joint capsule and can be damaged when the capsule is stretched during bleeds. Failure to restore proprioception will result in the inability of the joint to respond quickly enough to new stresses, and the potential for easy re-injury.

Normal range of motion and muscle length.
The goal with most exercises in this guide is to "continue until range/strength is equal to the opposite side." This only applies if the opposite side has full and "normal" range and strength, and the affected joint or muscle had full and "normal" range and/or strength to begin with.

Some people have developed chronic limitation of certain movements and "normal" range of motion is no longer possible. In these cases, the objective of the exercises is to prevent additional loss of function and to return the joint or muscle back to its usual state as soon as possible after new bleeds.

Everyday activities are important too.
Exercise is important to counteract the long-term effects of bleeding in the key joints and muscle groups. Many people find it difficult to stick to a regimented exercise program: it is important to remember that many everyday activities, such as walking, riding a bicycle, climbing stairs, or even shoveling snow can have beneficial effects too. However, specific exercises may be needed to work on certain trouble spots. The exercises in this guide are by no means the only exercises useful for people with hemophilia, but they have been chosen to meet specific goals.

"Exercise and joint rehabilitation don't come easily to me. However, when I discipline myself to follow my physical therapy protocol, I find myself with less pain, more motion and fewer bleeds. With exercise and hemophilia, slow and steady really does win the race. Pushing oneself too hard leads to setbacks, but stretching yourself just enough builds strength without causing bleeds."
– 26-year-old with severe hemophilia A, United States

"There are excellent static exercises that don't involve using weights. Yoga positions like the Bridge, the Plough, the Grasshopper, Heel-Toe, etc. are fantastic for stretching and toning. I do them every day and I can't recommend them highly enough."
– 49-year-old with severe hemophilia A, South Africa

"The non-compliance was sky high. Functional exercise is the best solution — even smaller children, coming in with a face like thunder and hating physiotherapy, turned out to be cooperative when normal activity was used as 'exercise.' "
– Physiotherapist, Netherlands

Section 3: Suggested Joint Exercises

The exercises in this section focus on the knee, ankle, and elbow joints. For each joint, exercises have been chosen that will help improve or maintain range of motion, muscle strength, and proprioception.

The exercises progress from simple to more difficult levels. Some are suitable to begin soon after a bleed, others are more advanced. It is not necessary to progress through all exercise levels for range of motion exercises before beginning the strengthening exercises. In fact, there is much overlap in these areas and range of motion, strengthening, and proprioception exercises should all be included in most programs.

"Exercise can be difficult when you have hemophilia, but the key is to find a good sense of balance between what is helpful and what is hurtful. Through experimenting you will be able to find your happy medium. You should try being active at an intensity that is not harmful to your body while still maximizing your abilities. Most importantly have fun with your activities, so it doesn't feel like a chore."
– 33-year-old with severe hemophilia, United States

"I play golf in the summer to stay fit. Unfortunately, these last few years, I have had a hard time finishing my 18 holes as, starting around the 13th or 14th hole, my joints became stiff and sore... and my performance suffered, not to mention that I had to spend the rest of the day resting. Moreover, I had to use a cart to move around. But after I followed an exercise program designed by my physiotherapist, I was able to improve my condition significantly. I can now play the 18 holes without showing any tiredness and I can even do it walking some days. My joints are not nearly as sore, their range of motion has improved and I feel in much better shape."
40-year-old with severe hemophilia A, Canada

Exercises for the Knee

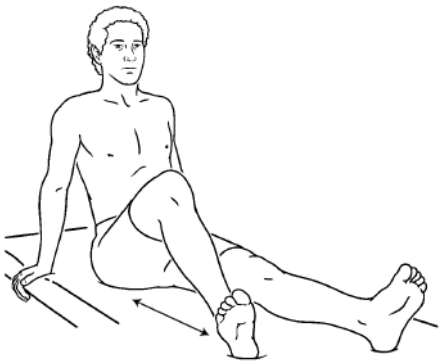
The knee is the joint most commonly affected by hemophilic bleeding. Being both a hinge joint and a weight-bearing joint, the **patellofemoral** joint is subject to many stresses during the course of a day. Knee extension is easily lost due to **reflex inhibition** of the quadriceps muscle and overuse or spasm of the hamstrings. Repeated bleeding causes thickening of the **synovium**, which can further limit knee extension.

Range of Motion

LEVEL 1

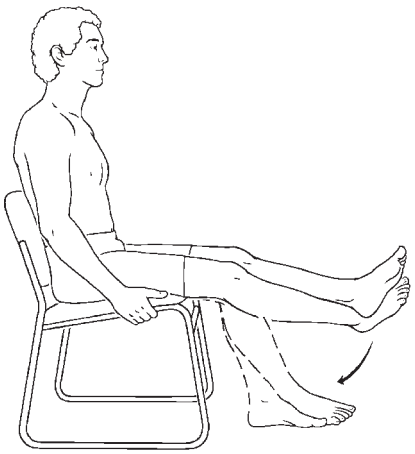
This exercise can be started as soon as bleeding has stopped.

Start: Sit with legs out straight (or lie on back).
Exercise: Bend hip and knee, and slide heel towards body. Then straighten knee by sliding heel away from body. Repeat several times.
Goal: Try to get the back of the knee as close to the surface as possible. Also try to bend the knee as much as the other knee can bend.



LEVEL 2

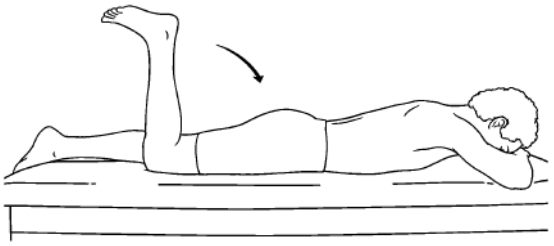
Start: Sit on chair. Support the weight of the affected leg with the other leg if necessary.
Exercise: Allow the knee to bend as much as is comfortable, then straighten the leg as far as possible.
Goal: Try to bend a bit more each time.



LEVEL 3

Note: If the person has difficulty lying on his stomach, it may be necessary to place a pillow under the waist so that the hip is more comfortable, or a pad under the thigh to take pressure off the knee cap.

Start: Lie on stomach.
Exercise: Bend knee and try to touch heel to buttocks. Assist with the other leg if necessary. Then straighten leg as far as possible.
Goal: Bend knee as much as knee could bend before the bleed.

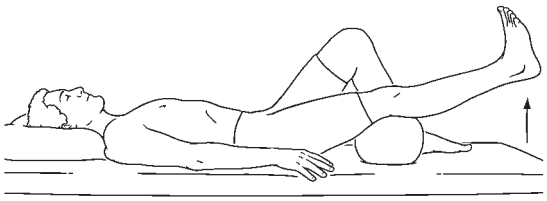


Strength

LEVEL 1

This exercise can be started as soon as bleeding has stopped.

Start: Lie on back with a roll under knee.
Exercise: Tighten the muscle at front of thigh, extend knee and lift heel. Hold for several seconds, then relax. Repeat until muscle feels tired.
Goal: Straighten knee completely or as straight as knee could go before the most recent bleed. Compare to other knee or baseline assessment.

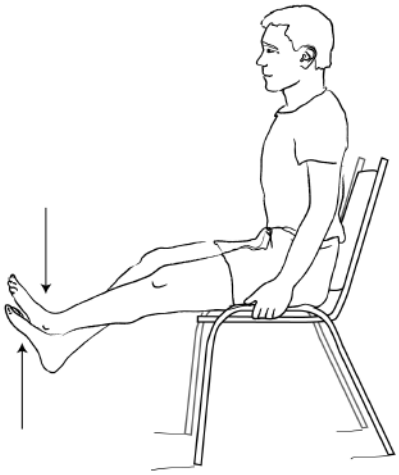


LEVEL 2

Start: Sit on a chair with knee bent.
Exercise: Extend knee, lifting the foot off the floor as far as possible. Hold for several seconds, then slowly return foot to floor. Repeat until muscle feels tired.
Goal: As above, straighten knee completely or as straight as knee could go before the most recent bleed. Increase repetitions. Compare to other knee or baseline assessment.

LEVEL 3

Start: Sit on chair. Cross ankle of uninjured leg over the ankle of the affected leg.
Exercise: Press ankles together as hard as possible. Hold for several seconds, then relax. Repeat with the knee bent at different angles. Repeat until muscle feels tired.
Goal: As above, straighten knee completely or as straight as knee could go. Continue until affected leg can exert strong pressure, equal to the unaffected leg.

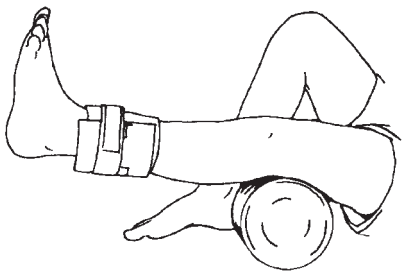


"Not too long ago – a couple of years back now – I went to a movie at the local cineplex. After the show, it took me so long to straighten my right leg and get to my feet that the cleaning staff came in and started sweeping the place out. After that happened a couple of times, I started weight training. Today I pressed 25 kg with that same leg, nearly half my body weight."
– 49-year-old with severe hemophilia A, South Africa

LEVEL 4

Start: Lie on back with a roll under knee. Place weight at ankle.
Exercise: Extend knee and lift heel. Hold for several seconds, then slowly lower foot back to surface. Repeat until muscle feels tired.
Goals: There are 3 ways to progress this exercise:

- Straighten knee as far as can be done without a weight (otherwise, the weight may be too heavy to start).
- Increase the length of time holding the extended position.
- Increase the number of repetitions.



LEVEL 5

Start: Stand with weight evenly on both feet.
Exercise: Squat down partway, keeping weight distributed evenly on both legs. Do not bend knees far enough to cause pain. Hold for several seconds. Return to upright position.
Goals: There are 3 ways to progress this exercise:

- Increase the length of time holding the flexed position.
- Increase the amount of knee bend (as long as it is not painful).
- Increase the number of repetitions.

LEVEL 6

Start: Stand with back against wall, feet apart.
Exercise: Slide down wall slowly, keeping knees pointed straight over toes. Go slowly and stop if there is any pain. Hold the position for several seconds, then return to upright position.
Goals: There are 3 ways to progress this exercise:

- Increase the length of time holding the flexed position.
- Increase the amount of knee bend (as long as it is not painful).
- Increase the number of repetitions.

LEVEL 7

Note: If this exercise causes pain, go back a few levels to increase strength first.

Start: Stand facing a step.
Exercise: Step up with affected leg. Keep knee pointed over toes and push with whole leg to raise body onto the top of the step. Repeat until leg feels tired.
Goal: Unless there is pain, practice until it is easy to step up onto a low stool or go up the steps at home, school, or work.

LEVEL 8

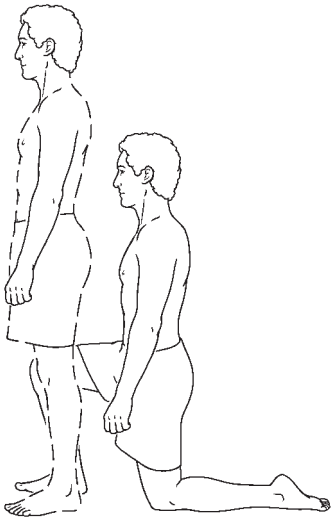
Start: Stand on a step facing down.
Exercise: Step off the step with strong leg first, letting affected knee bend. Gradually lower body until strong leg is just touching floor, then return to upright. Repeat until leg feels tired.
Goal: Unless there is pain, practice until it is easy to go down steps smoothly (no limp) and without using railing.

Note: Levels 8 and 9 are very difficult exercises and must be approached with caution. If these exercises cause pain, practice levels 6 and 7 to increase strength first. People who have experienced many bleeds into the knees may never be able to do levels 8 and 9 because of their level of difficulty. If this exercise causes pain, go back a few levels to increase strength first.

LEVEL 9

Note: If this exercise causes pain, go back a few levels.

Start: In kneeling position, bend affected knee and place foot flat on ground.
Exercise: Stand up using only the affected leg, without using hands. Repeat a few times, stop if knee is painful.
Goal: Unless there is pain, practice until this can be done easily.



Proprioception

Proprioception is the process by which the body reacts to position changes. Proprioception exercises are like balance exercises. Beginners should start these exercises close to a wall or piece of furniture so that they can steady themselves if necessary.

LEVEL 1

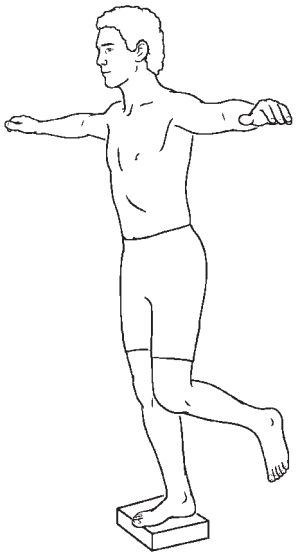
Start: Stand on affected leg.
Exercise: Maintain balance.
Goal: Practice until balance can be maintained for 30 seconds.

LEVEL 2

Start: Stand on affected leg with eyes closed.
Exercise: Maintain balance with eyes closed as long as possible.
Goal: Practice until balance can be maintained with eyes closed for 30 seconds.

LEVEL 3

Start: Stand on affected leg on an unstable surface (e.g., pillow, block of foam).
Exercise: Maintain balance.
Goal: Practice until balance can be maintained for 30 seconds.



LEVEL 4

Start: Stand on affected leg on an unstable surface and close eyes.
Exercise: Maintain balance with eyes closed as long as possible.
Goal: Practice until balance can be maintained with eyes closed for 30 seconds.

LEVEL 5

Note: Do not attempt this exercise if knee or ankle is swollen or painful.

Start: Stand on a stable surface at a small height (e.g., bottom step or low stool – 15-20 cm).
Exercise: Jump from the small height and keep balance on landing.
Goal: Practice until the landing feels secure. Increase height of jump only if required for function (e.g., dismounting from a bus or truck).

Exercises for the Ankle

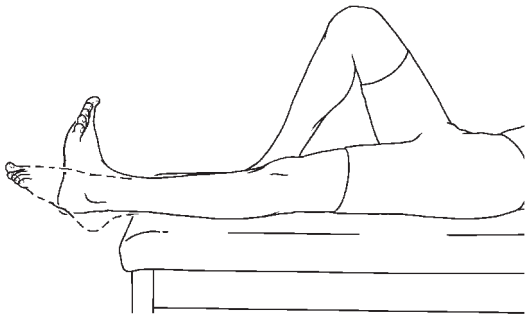
The ankle joint is also commonly affected by hemophilic bleeding. The **talocrural joint** is the usual site of bleeding, but bleeding can also occur into the **subtalar joint**. **Anterior** swelling interferes with ankle **dorsiflexion**. Repeated bleeding causes thickening of the synovium, which can further limit ankle dorsiflexion. Limited dorsiflexion causes the individual to walk on a plantarflexed ankle (on the toes), which is not a stable position, or to walk with the foot turned outward.

Range of Motion

LEVEL 1

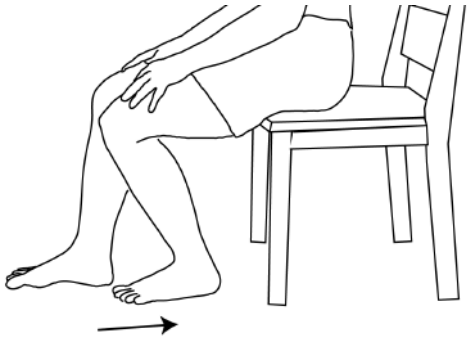
This exercise can be started as soon as bleeding has stopped.

Start: Lie in a comfortable position.
Exercise: Move foot up and down, in and out. Practice drawing shapes or letters of the alphabet with your foot, keeping the rest of the leg still.
Goal: Full ankle motion equal to the opposite ankle or baseline.



LEVEL 2

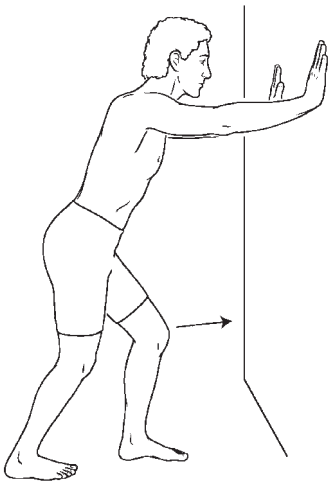
Start: Sit on a chair with knee bent and foot flat on floor.
Exercise: Slide heel back as far as possible, keeping heel down. It may feel as though there is pressure at the front of the ankle. Hold for several seconds, then relax. Repeat.
Goal: Try to slide the heel back a little bit further each time. Practice until full motion is restored. Compare to other ankle or baseline.



LEVEL 3

Note: Do not attempt this exercise if there is swelling or pain in the ankle.

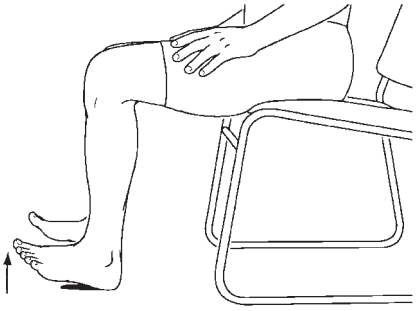
Start: Stand facing wall, with affected leg slightly ahead of the other. Place hands on wall, keeping both feet pointing toward wall.
Exercise: Gently move the knee toward the wall, while keeping the heel flat on the floor. Hold for a few seconds, then relax. Repeat.
Goal: Try to move knee closer to wall each time. Compare to other ankle or baseline.



Strength

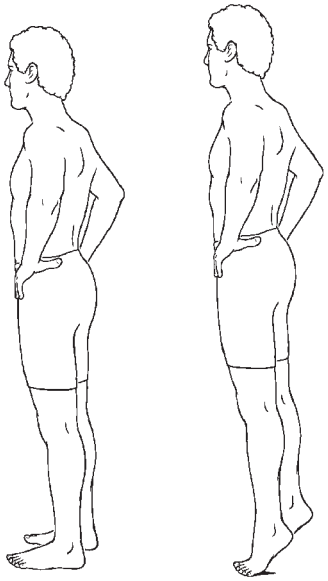
LEVEL 1

Start: Sit on a chair with knee bent and foot flat on floor.
Exercise: Lift front of foot off floor and hold for several seconds. Relax.
Goal: Repeat until leg muscle feels tired.



LEVEL 2

Start: Stand with weight on both feet.
Exercise: Lift both heels and stand on toes for several seconds. Relax.
Goal: Repeat several times, until calf muscle feels tired.

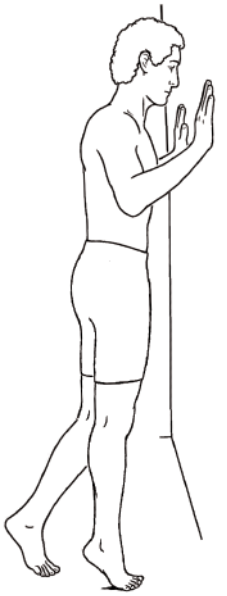


LEVEL 3

Start: Standing or walking.
Exercise: Walk several steps on tip toes. Then walk several steps on heels.
Goal: Repeat several times, until muscle feels tired. Increase by a few steps each day.

LEVEL 4

Start: Stand on affected leg. Hold onto something for balance.
Exercise: Raise heel off floor and hold. Relax. Repeat several times.
Goal: 25-30 repetitions. Do not continue if there is pain in the ankle during the exercise.



"Two of my patients have bad ankles. Because they each had both knees replaced in the last three years, they want to wait a little bit before thinking about ankle fusion. This can also be explained by the fact that their mobility and walking capacities improved a lot after the knee surgery. Nonetheless the pain is still severe in both ankles. So one part of the treatment was to teach them some exercises to mobilize the ankle combined by mobilization physiotherapy session each week. This treatment doesn't relieve the pain completely but the ankle surgery can be delayed."
– Physiotherapist, Belgium

Proprioception

LEVEL 1

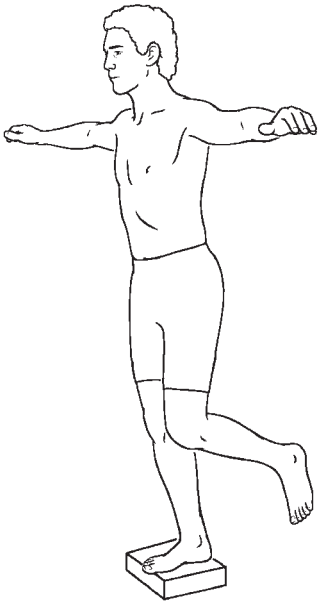
Start: Stand on affected leg.
Exercise: Maintain balance.
Goal: Practice until balance can be maintained for 30 seconds.

LEVEL 2

Start: Stand on affected leg with eyes closed.
Exercise: Maintain balance with eyes closed as long as possible.
Goal: Practice until balance can be maintained with eyes closed for 30 seconds.

LEVEL 3

Start: Stand on affected leg on an unstable surface (e.g., pillow, block of foam).
Exercise: Maintain balance.
Goal: Practice until balance can be maintained for 30 seconds.



LEVEL 4

Start: Stand on affected leg on an unstable surface and close eyes.
Exercise: Maintain balance with eyes closed as long as possible.
Goal: Practice until balance can be maintained with eyes closed for 30 seconds.

LEVEL 5

Note: Do not attempt this exercise if knee or ankle is swollen or painful.

Start: Stand on a stable surface at a small height (e.g., bottom step or low stool – 15-20 cm).
Exercise: Jump from the small height and keep balance on landing.
Goal: Practice until the landing feels secure. Increase height of jump only if required for function (e.g., dismounting from a bus or truck).

Exercises for the Elbow

The elbow consists of two joints: the **radio-humeral** joint is where flexion and extension of the arm takes place, while **pronation** and **supination** of the forearm occur at the **radio-ulnar** joint. Both joints are enclosed in a single synovial capsule, so either joint can be affected by bleeding in hemophilia. While a loss of elbow extension usually can be tolerated fairly well with only minimal impact on function, people are severely limited in many daily tasks when pronation and supination are affected.

Range of Motion

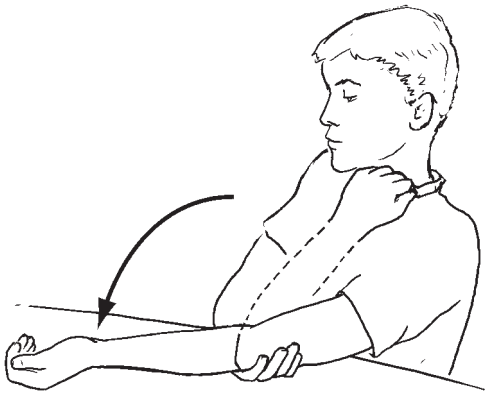
LEVEL 1

This exercise can be started as soon as bleeding has stopped.

Start: Sit in a comfortable position.
Exercise: Gently bend and straighten elbow.
Goal: Try to extend a little bit more with each repetition, but do not force the movement.

LEVEL 2

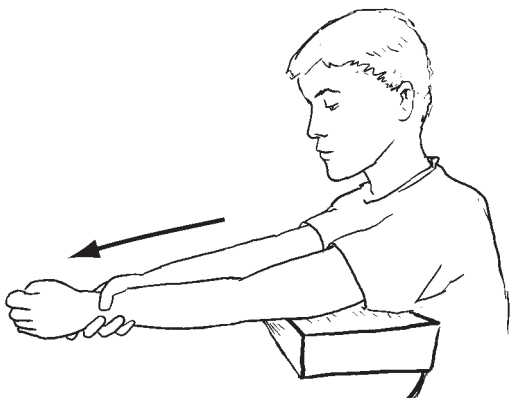
Start: Sit or lie with elbow supported.
Exercise: Extend elbow slowly, letting the weight of the arm assist. Repeat several times.
Goal: Try to straighten a bit further with each repetition, but do not force the movement.



LEVEL 3

Note: Do not attempt this exercise if there is swelling or pain in the elbow.

Start: Sit, resting elbow near edge of table.
Exercise: Straighten elbow as far as possible, assisting with the other hand.
Goal: Complete extension. Compare to other arm or baseline.



Forearm Rotation

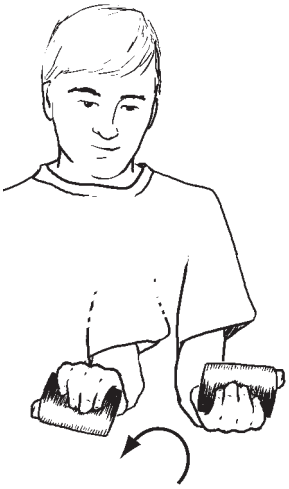
LEVEL 1

This exercise can be started as soon as bleeding has stopped.

Start: Sit in a comfortable position with elbow bent and arm supported.
Exercise: Turn palm of the hand up, then down. Repeat several times.
Goal: Try to turn palm without moving the rest of the arm. Try to turn palm upward a little bit more each time.

LEVEL 2

Start: Sit in a comfortable position with elbow bent. Hold a small weight in hand.
Exercise: Turn palm up and down. Let the weight help the arm turn further. Do not allow elbow to move away from body. Repeat several times.
Goal: Gently try to turn a bit further each time. Compare to other arm or baseline.

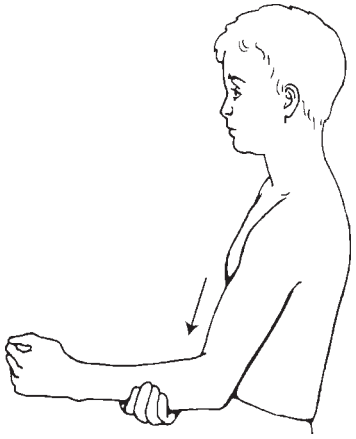


"I work with a man with severe bilateral elbow arthropathy. When he was 42 years old, I convinced him to start a fitness training. He is going to the gym two times a week. In two years, he lost 10 kg (which is very good for his two knee replacements) and the most important thing is that since this training, he doesn't have any elbow hemarthrosis (he used to have hemorrhagic accidents at least five times a year in each elbow). The exercises were simply biceps and triceps exercises carefully taught by a fitness instructor who was aware of the disease."
– Physiotherapist, Belgium

Elbow extension

LEVEL 1

Start: Place strong hand under affected arm.
Exercise: Press affected arm down into strong hand and hold for several seconds. Repeat several times, until arm feels tired.
Goal: Gradually increase pressure. Practice until affected arm can exert pressure equal to other arm.



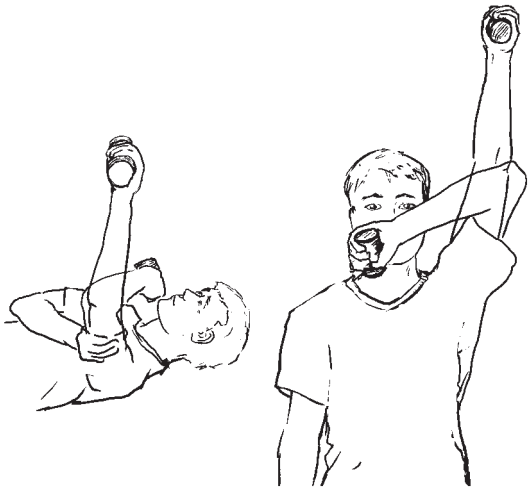
LEVEL 2

Start: Sit, or lie on back. Bend elbow and place hand near shoulder, with elbow pointing towards the ceiling.
Exercise: Extend arm and reach hand toward the ceiling. Hold several seconds, then relax. Repeat several times, until arm feels tired.
Goal: Practice until elbow can be straightened completely.

LEVEL 3

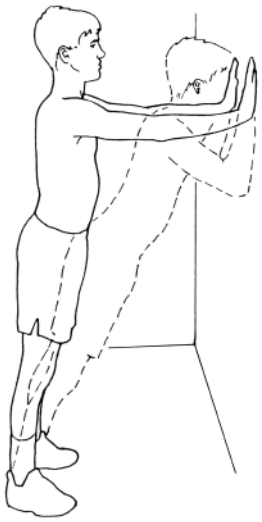
Start: Sit, or lie on back. Bend elbow and place hand near shoulder, with elbow pointing towards the ceiling. Hold a weight in hand.
Exercise: Extend arm slowly and reach hand toward the ceiling. Then slowly lower hand back toward shoulder. Repeat until arm feels tired.
Goal: Make sure elbow can extend as far as it can without the weight — if not, the weight may be too heavy.

- Gradually increase the number of repetitions.
- Increase the weight.



LEVEL 4

Start: Stand facing wall. Place hands flat on wall with arms straight.
Exercise: Lean body towards wall, allowing elbows to bend. Return to upright position by pushing with arms and straightening elbows.
Goal: Start with only small amounts of bending and progress through these levels only if the exercise remains pain free.

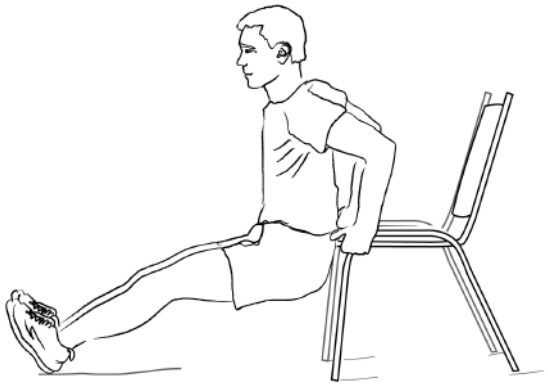


LEVEL 5

Note: The following exercises should not be attempted if there is pain or crepitus in the elbow, wrist or shoulder, or if the person is not able to support the weight of his body through the movement. Do not do this exercise if it causes pain in the elbow, wrist, or shoulder.

Start: Sit on edge of chair. Place hands on seat of chair.
Exercise: While holding the seat of the chair, move body forward and off the chair. Then let elbows bend slowly, controlling the weight of the body as it sinks towards the floor. Return to starting position.
Goal: This exercise can be progressed two ways:

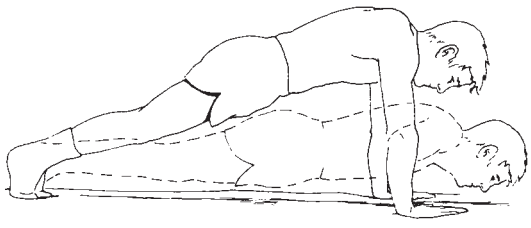
- Increase the number of repetition.
- Bend the elbows further.



LEVEL 6

Note: Do not do this exercise if is causes pain in the elbow, wrist or shoulder.
Start: Place hands flat on floor with elbows straight. If the person is strong enough, feet can be on floor as shown. Otherwise, place knees on floor.
Exercise: Slowly allow elbows to bend and lower the chest towards the floor. Go slowly, controlling the weight of the body, and stop if there is pain. Straighten the arms and return to starting position.
Goal: This exercise can be progressed two ways:

- Increase the number of repetition.
- Bend the elbows further.

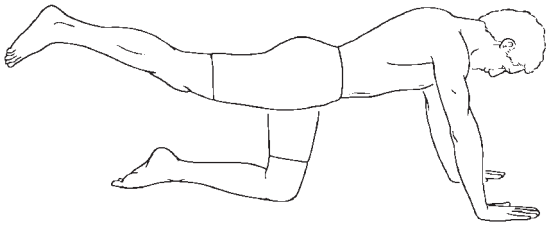


Proprioception

LEVEL 1

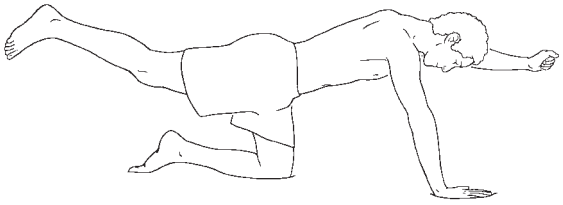
Note: Do not do these exercises if there is pain or swelling in elbow, wrist, or knee.

Start: On hands and knees, on floor or mat.
Exercise: Raise one leg backward while maintaining balance on the both arms. Maintain balance for several seconds then lower the leg. Repeat with opposite leg. Repeat until arms feel tired.
Goal: Maintain position for 30 seconds.



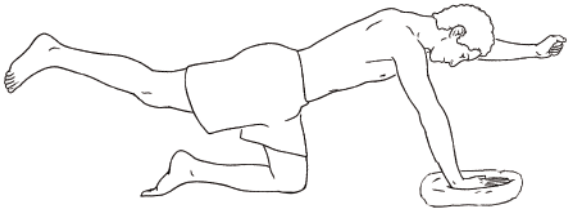
LEVEL 2

Start: On hands and knees, on floor or mat.
Exercise: Raise unaffected arm and the opposite leg (keep weight on the affected arm). Maintain balance for several seconds. Return to start position. Repeat until affected arm feels tired or shaky.
Goal: Maintain position for 30 seconds.



LEVEL 3

Start: On hands and knees with both hands on an unstable surface (e.g., a pillow).
Exercise: Raise one leg backward while maintaining balance on both arms. Maintain balance for several seconds then lower the leg. Repeat with opposite leg. Repeat until arms feel tired.
Goal: Maintain position for 30 seconds.



LEVEL 4

Start: On hands and knees with both hands on an unstable surface.
Exercise: Raise unaffected arm and the opposite leg (keep weight on the affected arm). Maintain balance for several seconds. Return to start position. Repeat until affected arm feels tired or shaky.
Goal: Maintain position for 30 seconds.

LEVEL 5

Note: Do not start until level 4 is achieved.

Start: On hands and knees with both hands on an unstable surface.
Exercise: Raise unaffected arm and the opposite leg. Close eyes. Maintain balance for several seconds then resume original position. Repeat.
Goal: Practice this exercise until balance can be maintained with eyes closed for 20 seconds.

Section 4: Suggested Muscle Exercises

Muscle bleeds are a real challenge to people with hemophilia, physicians, and physical therapists. Muscle bleeds are sometimes not recognized as bleeds and can be mistaken for a strained muscle. With deep muscle bleeds, there are often no visible signs.

Some muscles cross two joints; one joint may move perfectly but movement at the other joint may be affected. It is often only by testing the movements at both joints simultaneously that the problem becomes apparent. A sound knowledge of anatomy is essential to assess and rehabilitate the two-joint muscles.

It is also imperative to compare the combined muscle length of the affected limb to that of the opposite limb. Rehabilitation is not complete until there is enough muscle length to allow all the segments to move fully at the same time — a common error is to restore length to only one section of the muscle. For example, after a calf bleed, it may be possible to fully dorsiflex the ankle with the knee flexed, but not with the knee extended.

Muscle bleeds are also a challenge because they can create tremendous complications. Deep muscle compartment bleeds can cause temporary or permanent nerve impairment, and if the pressure is severe, **arterial compression** and **muscle necrosis** can result.

Some muscles, because of their location and function, are difficult to rest adequately. Many of the muscles most commonly affected by hemophilic bleeds react to injury by weakening. Most muscles lose some flexibility as they heal. Recurrence of bleeding after a few days of improvement is not unusual.

Ideally, progress and resolution of **hematomas** are tracked with diagnostic ultrasound. When this is not possible, careful attention to the clinical assessment is crucial. The patient can usually tell whether the muscle is feeling looser and less painful as the exercises progress or if the muscle is becoming more painful. The physical therapist must listen carefully to the patients.

Supporting the limb with a splint between exercise sessions, in a position of comfort while maintaining some length, may be very helpful to regain muscle length. The splint can be adjusted as muscle length improves.

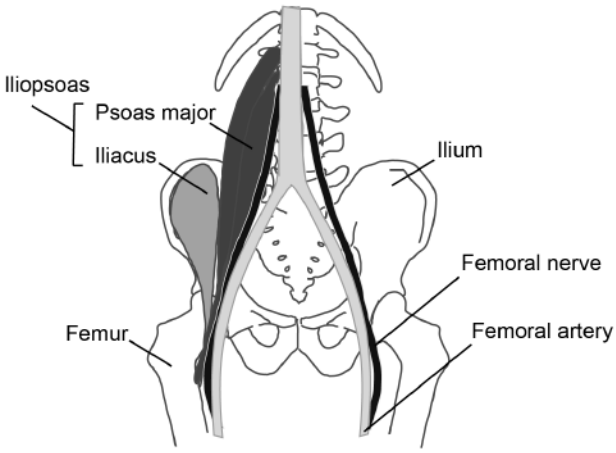
Rehabilitation of muscles must also include strengthening exercises to restore power and build endurance.

The following exercises will help stretch or lengthen muscles that have become tight due to bleeding or in response to joint bleeds. These stretches must be done as active, not passive, stretches, without external assistance from therapists or caregivers. They must be done with great care in order to avoid further injury to the muscle and new bleeds.

Stretches must be done slowly and gradually. The limb should be stretched only until the point where the muscle begins to feel tight, no further. The stretch should be held for several seconds, then relaxed. It may be possible to gently stretch a tiny bit further with each subsequent stretch, but the individual must be taught not to stretch too far.

Exercises for each muscle have been chosen that will restore length (flexibility) and muscle strength. The exercises focus on the following muscles: **iliopsoas** (hip flexor), **gastrocnemius** (calf), **hamstrings**, **forearm flexors**, and **quadriceps**.

Exercises for the Iliopsoas (Hip Flexor)



Located deep in the pelvis, the hip flexor is a common site of bleeding in teenagers and young adults with hemophilia. The psoas portion of the muscle attaches to the spine as well as the **femur**; tightness of this muscle or injury to it causes the hip to flex and the back to arch.

The femoral nerve and femoral artery lie adjacent to the psoas muscle, therefore bleeding at this site can have serious consequences. Pressure on the nerve can lead first to numbness and loss of sensation along the front of the thigh. *This is an important early warning sign*. If pressure continues to increase on the femoral nerve, the quadriceps muscle will weaken and there will be difficulty straightening the knee. This can be a serious and permanent result of a psoas bleed.

Key points about the psoas:

- A psoas muscle bleed can take many weeks and even months to resolve completely. Therefore, rehabilitation needs to be slow and carefully supervised.
- Psoas bleeds must be rested completely until the bleeding has stopped. This means no walking is allowed at first, not even with crutches.
- Numbness or tingling at the front of the thigh is an early indication of nerve damage. If this happens, consult a treatment centre or hemophilia specialist immediately for an assessment.
- Rehabilitation, towards regaining full flexibility and restoring strength, must be carried out under the close supervision of a physical therapist.
- The psoas muscle can re-bleed easily even after it seems to be recovering. Be patient and be prepared for the patient to resume bedrest if there are any signs of a new bleed, such as increasing pain or difficulty moving.

Flexibility

Resting in a sitting position or lying on the back with the leg supported on lots of pillows may be necessary for days, possibly even weeks. During this time, keep the hip flexed in its comfortable position and do not try to walk. Once it is certain that the bleeding has stopped, the following flexibility exercises may be attempted. However, be prepared to stop the exercises and continue with rest if the bleeding starts again.

LEVEL 1

This exercise should be started only after the bleeding has stopped, and must be discontinued immediately if the bleeding starts again.

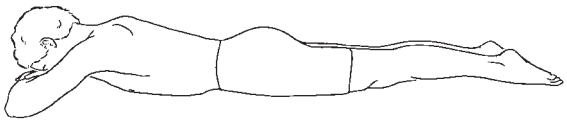
Start: Lie on back with both hips and knees bent and feet flat. This helps keep the back flat along the surface. Keep back flat by tightening the abdominal muscles (pulling belly in).
Exercise: Gently extend the affected leg until a slight pulling sensation is felt in the hip/groin region — do not extend any further. Support the movement with hands if necessary. Place a pillow or roll under the thigh and allow the leg to relax in this position. Repeat this exercise every hour.
Goal: As the muscle relaxes and the leg is able to be extended more, decrease the height of the roll.

- Continue this exercise for as many days as it takes to flatten the affected leg along the surface while the opposite knee is bent.
- Do not attempt to walk until the leg can rest completely flat without any strain felt in the hip/groin or lower back.
- Stop the exercise immediately if there is increased discomfort in the groin, back, or thigh, and continue to rest with the leg supported in a comfortable position.

LEVEL 2

This exercise should be done only after level 1 is completed successfully.

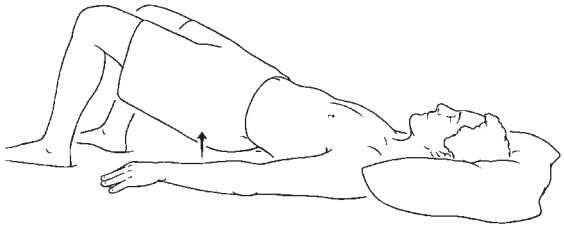
Start: Lie on stomach.
Exercise: Keep hips flat on surface. Rest in this position, letting the hips and back relax. Stop immediately if there is increased discomfort in the groin, back, or thigh.
Goal: If this exercise is comfortable, short walks with very small steps may be attempted indoors.



LEVEL 3

This exercise should be done only after level 2 can be done without discomfort.

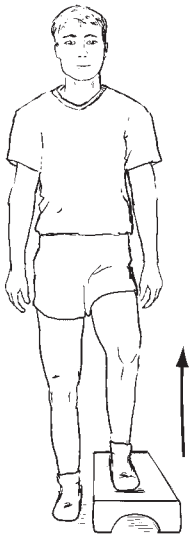
Start: Lie on back with both knees bent and both feet flat. Keep belly pulled in.
Exercise: Push heels into the ground and lift hips until a gentle stretch is felt in the groin. Hold for several seconds, then relax.
Goal: Lift hips, without causing discomfort, until hips are extended completely and back does not arch.



LEVEL 4

This exercise, which prepares the leg for walking, should be done only after level 2 can be done without discomfort and level 3 has been practiced for several days.

Start: Stand beside a step.
Exercise: Place the affected leg sideways up on the step. Push down through affected leg and extend knee to step up onto step.
Goal: Step up easily, without using hands and keeping back straight.



LEVEL 5

This exercise should be done only after levels 3 and 4 can be done comfortably.

Start: Lie on back with affected leg straight and non-affected leg bent.
Exercise: Slowly bend the non-affected thigh toward the chest, assisting with hands if necessary, but keep the affected leg flat on the surface. Stop and hold the position as soon as there is a stretch felt in the affected groin or back, or when the affected thigh begins to lift off the surface.
Goal: Practice this exercise for as many days as it takes to be able to flex the non-affected thigh completely to the chest while keeping the affected thigh flat on the surface. When this can be done successfully, walking can be increased but running should not be attempted.

LEVEL 6

This level must be instructed by an experienced physical therapist (preferably an HTC physical therapist), who will assign active (not passive) exercises that stretch the hip flexor beyond neutral extension as suitable to the individual.

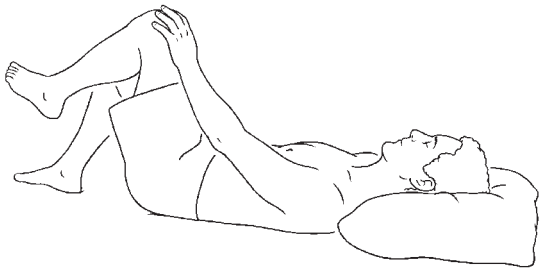
It is important to do exercises gently and slowly, and continue until full muscle length has been restored. If there is incomplete lengthening, gait and posture will be affected and the likelihood of re-bleeding is increased.

Running should not be attempted until the physical therapist has advised that it is safe to do so.

Strength

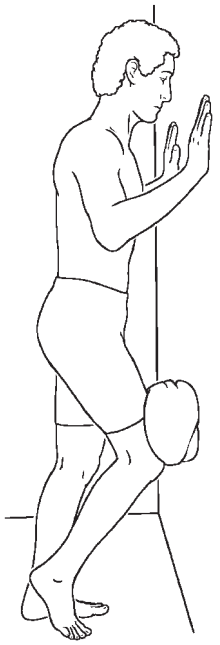
LEVEL 1

Start: Lie on back with knees bent. Place hand on top of affected knee.
Exercise: Bend the affected leg towards chest. Press hand and knee together, gently and gradually increasing the pressure — there should be no pain. Hold for several seconds then relax. Repeat until the affected leg begins to feel tired.
Goal: Increase pressure until leg can exert pressure equal to the pressure being applied by the hand.

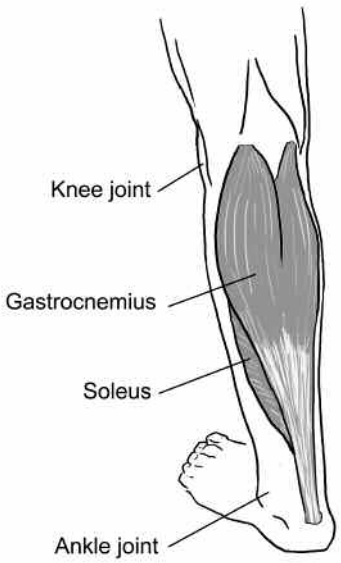


LEVEL 2

Start: Stand facing a wall. Place a pillow between affected thigh and wall.
Exercise: Press thigh against the wall, gradually building up the pressure. Hold for several seconds, then relax. Discontinue this exercise if there is pain felt in the affected hip/groin or lower back.
Goal: Gradually increase pressure and time that the position is held. Increase repetitions. Compare to other side.



Exercises for the Gastrocnemius (Calf Muscle)



The calf muscle consists of two major muscles, gastrocnemius and soleus. Bleeds into one or both of these muscles are quite common. The gastrocnemius crosses the knee as well as the ankle. Rehabilitation is not complete until there is enough muscle length to allow full dorsiflexion of the ankle with the knee completely extended.

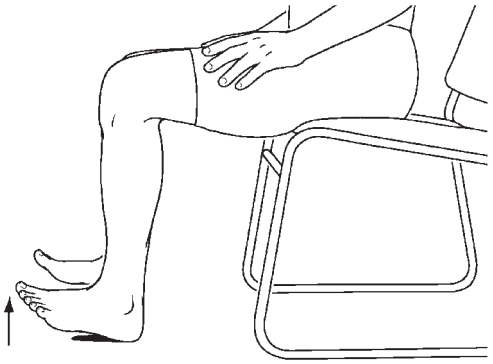
There is also a deep muscle compartment that contains muscles that flex the toes. Bleeds here are less common, but can be serious because there are nerves and vessels in the compartment that can be compressed. Depending on which muscle has been injured, it may be necessary to restore full flexibility of the ankle, knee, and toes.

Note: These exercises should not be attempted if there is a bleed in the muscle. Begin only after bleeding has stopped.

Flexibility

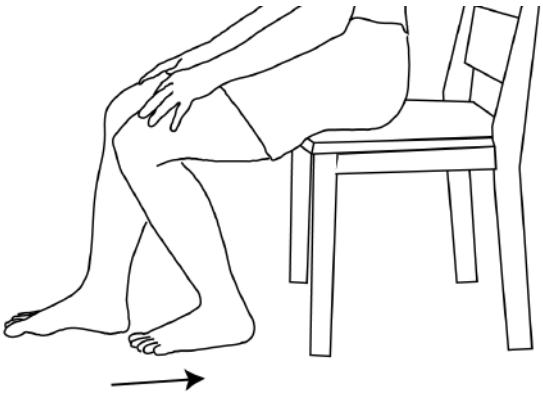
LEVEL 1

Start: Sit with feet flat on floor.
Exercise: Lift front of foot and keep heels down, until a stretch is felt in the calf. Hold for several seconds, then relax.
Goal: Practice until full ankle motion is possible with no stretch felt in calf.



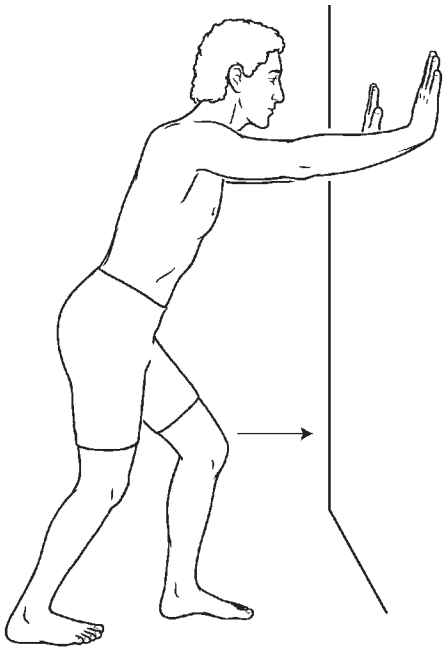
LEVEL 2

Start: Sit, foot flat on floor, with knee extended as needed to allow the foot to be flat.
Exercise: Keeping heel flat on floor, slowly flex the knee and slide the heel back until a stretch is felt in the calf. Hold for several seconds, then relax.
Goal: Try to slide heel back a bit more with each repetition. Compare to opposite leg.



LEVEL 3

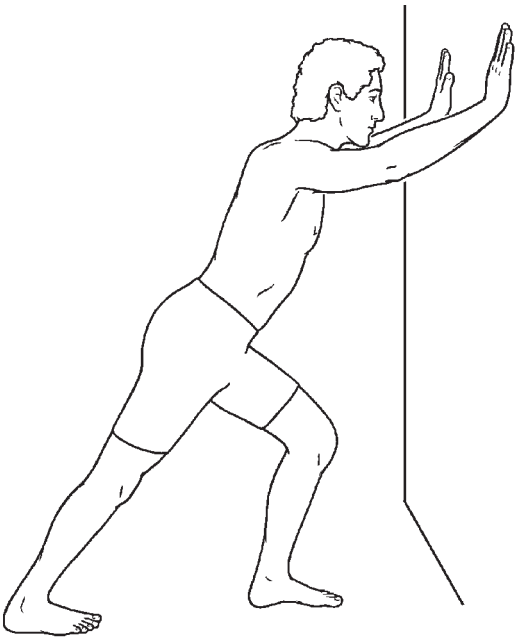
Start: Stand facing wall with affected foot slightly ahead of the other. Place hands on wall.
Exercise: Keeping heel flat on the floor, press knee of affected leg towards the wall. Stop when a stretch is felt in the calf muscle.
Goal: Practice until flexibility is equal on both legs. Do not begin walking without aids until this level is achieved.



LEVEL 4

This exercise can be attempted once level 3 is achieved comfortably.

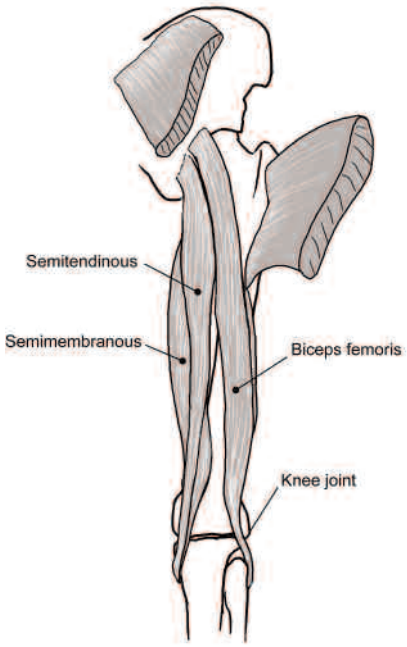
Start: Stand facing wall, with hands on wall at shoulder height.
Exercise: Step back slightly with affected leg, and place heel flat on ground. Keeping the knee straight, lean body toward the wall. Stop when a stretch is felt in the calf.
Goal: Compare flexibility with opposite leg. Practice until both are equal, or leg is comparable to baseline.



Strength

Once the person resumes walking, this muscle usually regains its strength without difficulty.

Exercises for the Hamstrings



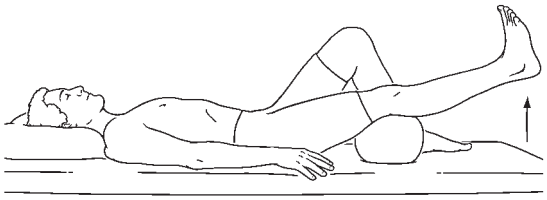
The hamstrings consists of three muscles that cross the hip joint as well as the knee joint. Injuries to the hamstrings are quite common in sports, even in people without hemophilia, and can be very difficult to rehabilitate fully. When injured, these muscles go into extreme spasm; they can be difficult to strengthen sufficiently without causing new bleeds.

Note: These exercises should not be attempted if there is a bleed in the muscle. Begin only after bleeding has stopped. Many adolescents have very tight hamstrings during periods of rapid growth.

Flexibility

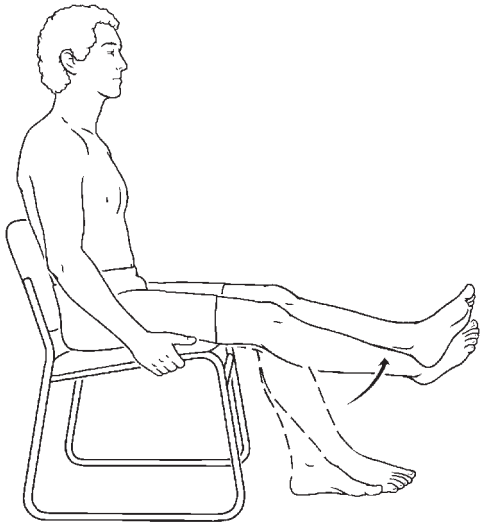
Exercises to improve flexibility must be done slowly and smoothly. Bouncing or lunging to try to stretch more is not an effective way to stretch and could cause a bleed.

LEVEL 1



Start: Lie with thigh supported and knee bent in a comfortable position.
Exercise: Straighten the knee and slowly lift the heel off surface. Stop at the first sign of discomfort in the back of the thigh. Hold for several seconds, then relax.
Goal: With each repetition, try to straighten the knee a little bit more, until it can be extended fully with no discomfort in the muscle.

LEVEL 2



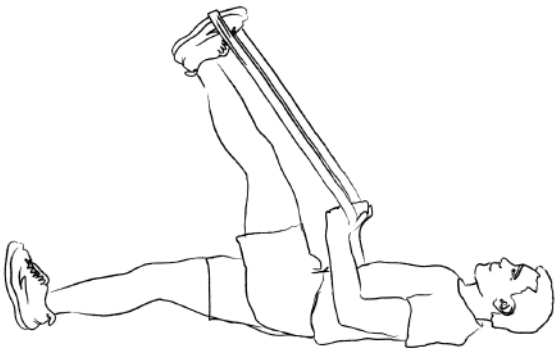
Note: This exercise may be difficult, especially for adolescents following a growth spurt. Check the unaffected leg first.

Start: Sit on a chair, with back straight and knees bent.
Exercise: Straighten affected knee until a stretch is felt at the back of the thigh. Assist with the other leg if necessary. Do not allow pelvis to rotate, or spine or back to curve.
Goal: Straighten the knee fully while keeping the back straight. Compare capability to other leg.

LEVEL 3

Note: This is an advanced stretch.

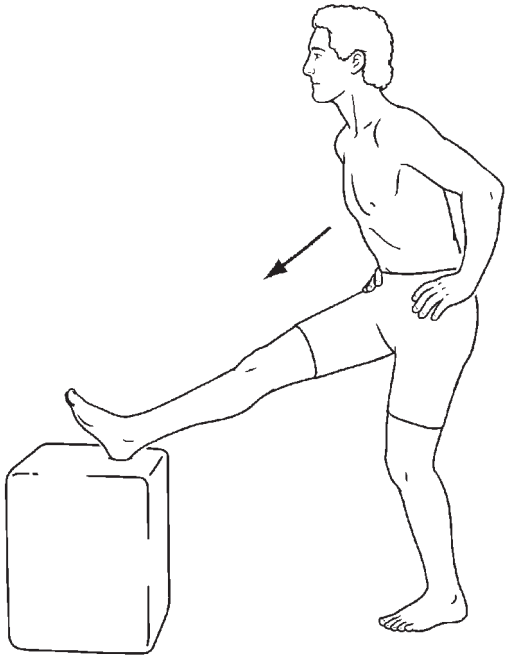
Start: Lie on back on floor with both legs straight.
Exercise: Bring the affected thigh towards chest and place a strap or towel around bottom of the foot. While holding the strap with both hands, slowly straighten the affected knee, pressing the heel towards the ceiling. Press gently until a stretch is felt at the back of the thigh. Hold for several seconds, then relax.
Goal: Equal flexibility in both legs. Practice until flexibility is equal in both legs or comparable to baseline.



LEVEL 4

Note: This is a difficult stretch. Do not attempt unless level 3 has been practiced for several days.

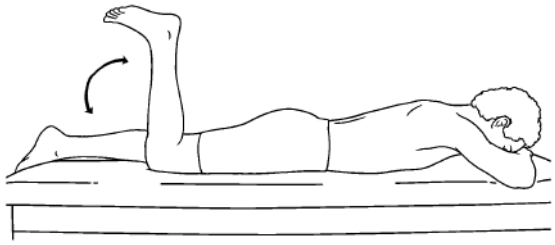
Start: Stand and place foot of affected leg on a chair or step.
Exercise: Lean forward from the waist towards the foot on the chair. Keep the back straight, and do not reach with hands.
Goal: The objective is to lean the pelvis forward over the leg, keeping knee extended. Compare capability with other leg and practice until flexibility is equal in both legs or comparable to baseline.



Strength

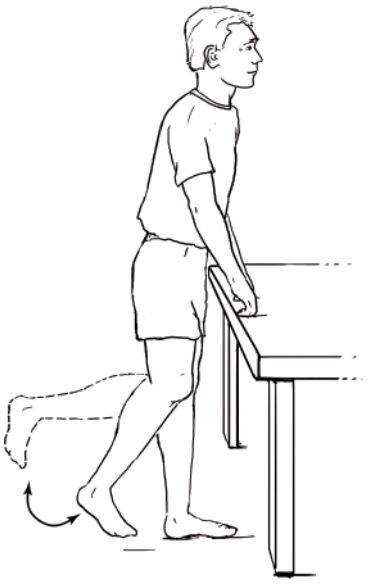
LEVEL 1

Start: Lie on stomach.
Exercise: Bend affected knee slowly until knee is bent to 90 degrees, then lower foot slowly. Repeat several times, until muscle feels tired.
Goal: Increase the number of repetitions gradually. Work up to 30 repetitions.



LEVEL 2

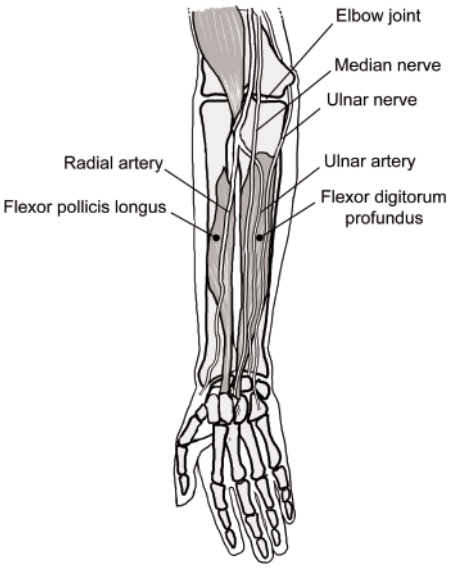
Start: Stand and hold a wall or furniture for support.
Exercise: Bend the affected knee to 90 degrees, keeping both knees close together, then slowly lower foot back to ground. Repeat several times, until the muscle begins to feel tired.
Goal: Increase the number of repetitions gradually. Work up to 30 repetitions.



LEVEL 3

Start: Stand and hold a wall or furniture for support. Attach a small weight to the ankle of the affected leg.
Exercise: Bend the affected knee to 90 degrees, keeping both knees close together, then lower foot slowly back to start position. Repeat several times, until the muscle begins to feel tired.
Goal: Gradually increase number of repetitions. Compare to opposite leg.

Exercises for the Forearm Flexors



Bleeds into the superficial muscles of the forearm are relatively easy to diagnose and manage because the hematoma is usually **palpable** and the swelling may be visible. Bleeds into the deep flexor compartment of the forearm, however, are sometimes missed in their early stages. Pain in the arm, increased by straightening the fingers and bending the wrist back, quickly confirms the diagnosis.

The deep compartment contains the **flexor digitorum profundus**, **flexor pollicis longus**, median and ulnar nerves, and radial and ulnar arteries. Bleeding into this enclosed space causes extreme discomfort, but no visible swelling. As the compartment pressure increases, there will be increasing pain, **paresthesia**, and in the worst cases, muscle necrosis.

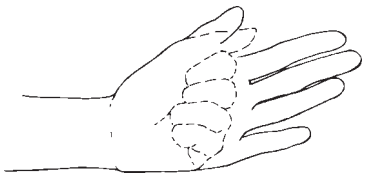
The flexor digitorum profundus crosses the elbow, the wrist, and all the finger joints; full length must be restored across each of these joints separately first, and then to all joints together before rehabilitation can be considered as completed.

Note: These exercises should not be attempted if there is a bleed in the muscle. Begin only after bleeding has stopped.

Flexibility

LEVEL 1

This level has 3 parts, to stretch each part of the muscle separately.

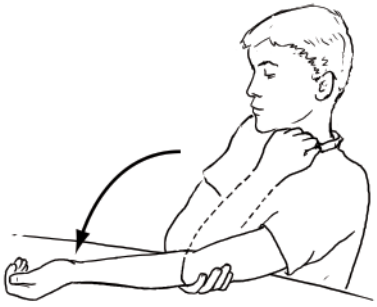


Part 1:

With the wrist and elbow in a comfortable position, open fingers. Repeat several times, trying to open fingers a bit more each time.

Part 2:

With the fingers in a relaxed position, extend wrist. Repeat several times, trying to extend the wrist more each time. Stop if there is increased discomfort in the forearm.



Part 3:

With the wrist and fingers in a comfortable position, extend the elbow completely. Repeat several times. Stop if there is increased discomfort in the forearm.

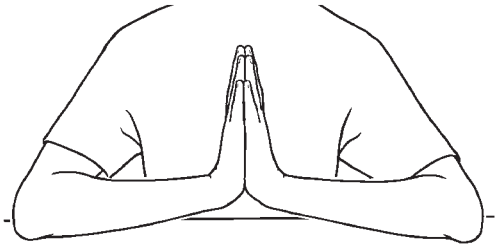
Goal: For each part of this exercise, compare the movement to the opposite side. Motion must be full at each joint, with no discomfort.

LEVEL 2

This level combines two of the three movements.

Part 1:

Start: With arm resting on a table, extend fingers as far as possible.
Exercise: Keeping the fingers straight, gently extend the wrist until a stretch is felt in the forearm. Hold for several seconds, then relax.
Goal: Practice until the amount of stretch feels the same on both arms.

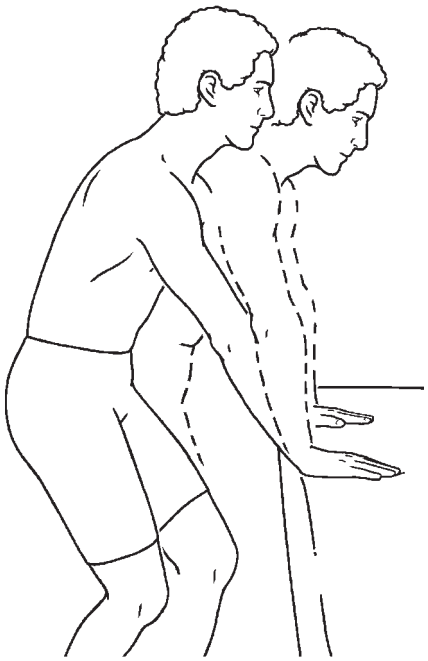


Part 2:

Start: Place palms of hands together with fingers straight. Rotate hands upward (into prayer or greeting position).
Exercise: While keeping hands pressed flat together, lift the elbows until a stretch is felt in the forearm. Hold for several seconds, then relax.
Goal: Practice until the amount of stretch feels the same on both arms.

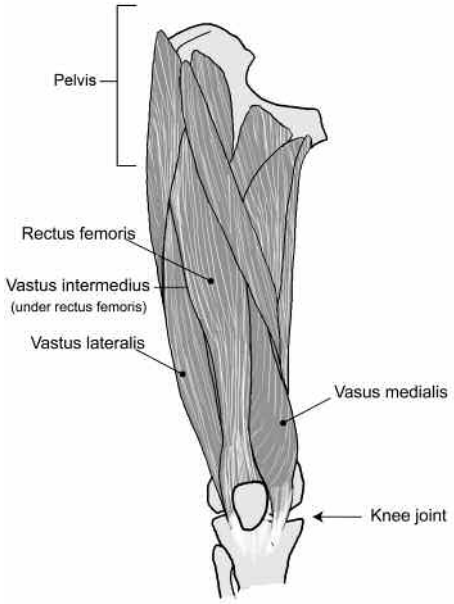
LEVEL 3

This level combines all three movements, and must be done carefully.



Start: Stand, placing hands flat on table, with all fingers straight and the wrists extended.
Exercise: Straighten the elbows, and lean gently onto outstretched hands. Apply pressure through the affected arm only until a stretch is felt. Hold for a few seconds, then relax.
Goal: Practice until the amount of stretch feels the same in both arms.

Exercises for the Quadriceps



The quadriceps are four muscles at the front of the thigh. They are most often injured by a direct blow to the front of the thigh. Swelling and tenderness are obvious. It is not uncommon for larger hematomas to **calcify**.

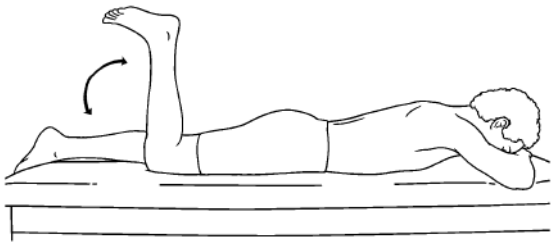
Three of the four quadriceps cross only the knee; when knee flexion is full, muscle length is full. The rectus femoris muscle also crosses the front of the hip joint. Rehabilitation is not complete until the knee can be flexed fully with the hip in an extended position.

Note: Do not begin walking without an aid until the knee can bend easily to 90 degrees, or to the baseline amount of knee flexion without discomfort felt in thigh.

Flexibility

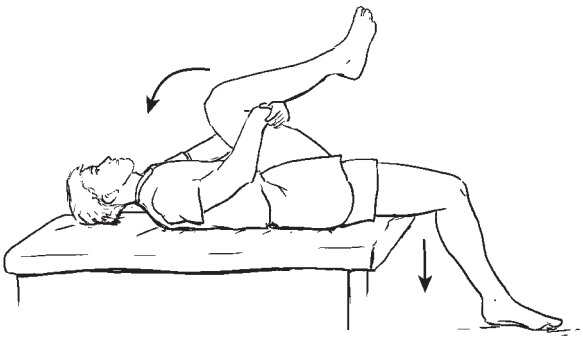
LEVEL 1

Start: Lie on stomach. A small pillow may be needed under the hips if the hips are very tight.
Exercise: Keeping hips as flat as possible on surface, bend knee of the affected leg. Repeat several times, trying to bend the knee further each time.
Goal: Compare to other leg. Practice until amount of knee bend is equal and without discomfort.



LEVEL 2

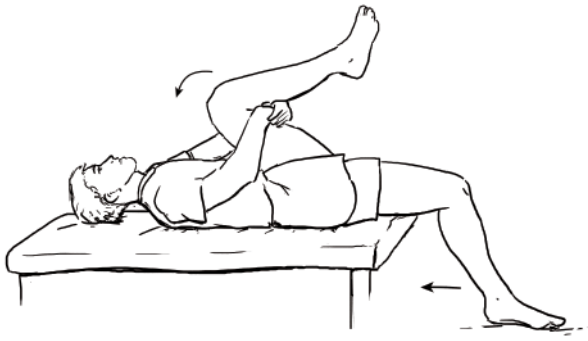
Start: Lie on back with affected leg close to the edge of the bed. Let the knee bend over the edge of the bed. It is preferable to let the foot rest on the floor to start.
Exercise: Flex the non-affected thigh towards the chest, assisting with hands. Stop flexing as soon as there is a stretching sensation in the affected thigh. Hold this position for several seconds, then relax. Repeat a few times, but stop if discomfort increases in affected thigh.
Goal: Practice until the affected leg remains flat on the surface when the opposite thigh is flexed to the chest.



LEVEL 3

Note: Do not attempt this exercise until level 2 can be done without discomfort.

Start: Lie on back with affected leg close to the edge of the bed. Let the knee bend over the edge of the bed. It is preferable to let the foot rest on the floor to start.
Exercise: Flex the non-affected thigh towards the chest, assisting with hands. Stop flexing as soon as there is a stretching sensation in the affected thigh. Keep thigh flat on bed. Slowly bend knee until stretch is felt in thigh. Hold, then relax.
Goal: Practice until flexibility is equal in both legs, or comparable to baseline.



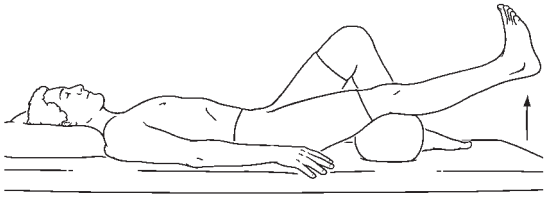
"I was scheduled for a knee replacement but careful exercise and walking helped to regain range of motion and strength, and reduce pain. Now I'm walking comfortably and the surgery was cancelled."
– 54-year-old with severe hemophilia B, Canada

Strength

LEVEL 1

This exercise can be started as soon as bleeding has stopped.

Start: Lie on back with a roll under knee.
Exercise: Tighten the muscle at front of thigh, extend knee and lift heel. Hold for several seconds, then relax. Repeat until muscle feels tired.
Goal: Gradually increase number of repetitions. Muscle should not feel more sore after exercises.

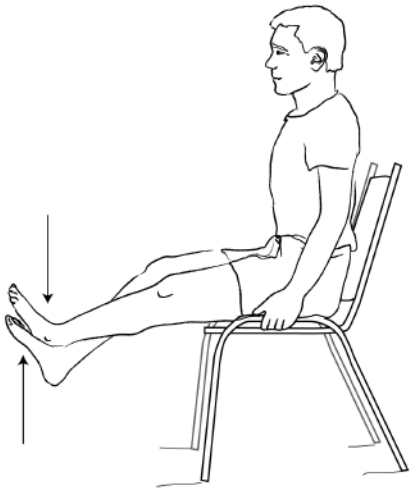


LEVEL 2

Start: Sit on a chair with knee bent.
Exercise: Extend knee, lifting the foot off the floor as far as possible. Hold for several seconds, then slowly return foot to floor. Repeat until muscle feels tired.
Goal: Gradually increase number of repetitions.

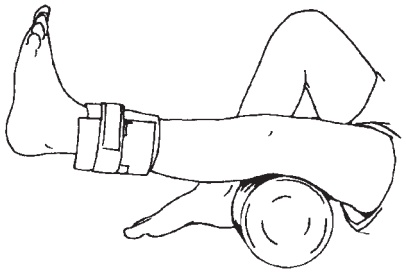
LEVEL 3

Start: Sit on chair. Cross ankle of uninjured leg over ankle of the affected leg.
Exercise: Press ankles together as hard as possible. Hold for several seconds, then relax. Repeat with the knee bent at different angles. Repeat until muscle feels tired.
Goal: Practice until affected leg can exert pressure equal to unaffected leg.



LEVEL 4

Start: Lie on back with a roll under knee. Place weight at ankle.
Exercise: Extend knee and lift heel. Hold for several seconds then lower foot back to surface slowly. Repeat until muscle feels tired.
Goal: Increase number of repetitions. Compare to other leg.



LEVEL 5

Start: Stand with weight evenly on both feet.
Exercise: Squat down partway, keeping weight distributed evenly on both legs. Do not bend knees far enough to cause pain. Hold for several seconds. Return to upright position.
Goals: There are 3 ways to progress this exercise:

- Increase the length of time holding the flexed position.
- Increase the amount of knee bend (as long as it is not painful).
- Increase the number of repetitions.

LEVEL 6

Start: Stand with back against wall, feet apart.
Exercise: Slide down wall slowly, keeping knees pointed straight over toes. Go slowly and stop if there is any pain. Hold the position for several seconds, then return to upright.
Goals: There are 3 ways to progress this exercise:

- Increase the length of time holding the flexed position.
- Increase the amount of knee bend (as long as it is not painful).
- Increase the number of repetitions.

LEVEL 7

Note: If this exercise causes pain in the muscle, go back a few levels to increase strength first.

Start: Stand facing a step.
Exercise: Step up with affected leg. Keep knee pointed over toes and push with whole leg to raise body to the top of the step. Repeat until leg feels tired.
Goal: Practice until you can go up a whole flight of stairs smoothly and easily.

LEVEL 8

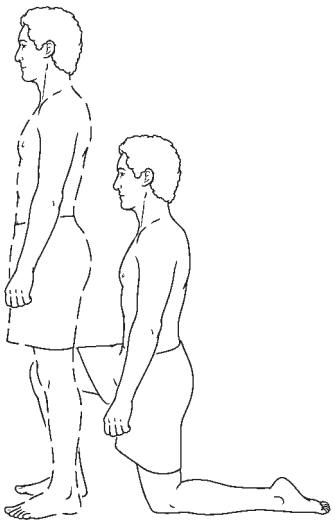
Note: If this exercise causes pain in the muscle, go back several levels to increase strength first.

Start: Stand on a step facing down.
Exercise: Step off the step with strong leg first, letting affected knee bend. Gradually lower body until strong leg is just touching floor, then return to upright. Repeat until leg feels tired.
Goal: Practice until you can go downstairs smoothly without limping.

LEVEL 9

Note: If this exercise causes pain in the muscle, go back several levels.

Start: In kneeling position, bend affected knee and place foot flat on ground.
Exercise: Stand up using only the affected leg, without using hands. Repeat a few times – stop if knee is painful.
Goal: Practice until you can get up from the floor easily, without using hands.



Conclusion

With this graduated exercise program, most of the chronic postural changes that occur in people with hemophilia can be avoided. By maintaining mobile joints and strong, flexible muscles, all people with hemophilia should be able to continue with their regular daily activities at home, school, and work.

If you have any questions about any of these exercises, please discuss them with the physical therapist at your closest hemophilia treatment centre, or contact the WFH Musculoskeletal Committee.

Musculoskeletal Committee
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"We usually give the SIAGAS speech: 'Swimming Is As Good as Soccer' – but in our country it doesn't work very well."
– Orthopedic surgeon, Colombia

"Football (soccer) is a global religion – can you invent new rules for this beautiful game so that it is really safe for us hemophiliac kids to play? How about holding World Hemophilia Olympic Games for us?"
– Teenager with hemophilia, Malaysia

Glossary of Terms

Arterial compression: Pressure on an artery that impedes circulation of the blood.

Arthropathy: A disease or abnormality of a joint; hemophilic arthropathy refers to joint damage caused by repeated bleeding into a joint space.

Baseline: Refers to the usual state of the muscles and joints of someone who has chronic joint disease, for whom the usual range of motion may not be full or "normal," but it is normal for him.

Biceps brachii: The muscle of the upper arm that bends the elbow and turns the palm up.

Calcify: Calcium deposited in a healing tissue.

Crepitus: A grating sound or sensation. Articular crepitus is produced by friction between bone and cartilage.

Dorsiflexion: The bending backward of the body or a body part; ankle dorsiflexion refers to the bending of the foot towards the leg with toes pointing upward.

Extensor: A muscle that extends or straightens a body part (e.g., arms, legs, fingers, etc.) as opposed to the flexor.

Femur: The thigh bone that extends from the hip to the knee, the largest and strongest bone of the human body.

Flexion: The bending of a joint or body limb so that the angle between the bones of a limb is decreased.

Flexor: A muscle that bends a limb or body part.

Flexor digitorum profundus: A muscle in the forearm that flexes the fingers.

Flexor pollicis longus: A muscle in the forearm that bends the thumb.

Forearm: The area of the arm between the wrist and the elbow, a common area for muscle bleeds.

Forearm flexors: Muscles that lie along the inner sides of the forearms.

Gastrocnemius: The main muscle of the calf of the leg, which points the foot down and helps bend the knee.

Hamstrings: A group of muscles at the back of the upper leg that bend the knee joint and help to extend the hip.

Hematoma: A localized swelling under the skin caused by a break in a blood vessel. Swelling results from the accumulation of clotted or partly clotted blood.

Iliopsoas: The large flexor muscle of the hip joint, which bends the thigh to the chest.

Isometric: A system of exercises where muscles contract and generate force without causing motion at the adjacent joints.

Lumbar: The lower back (between the lowest ribs and the pelvis).

Lordosis: Forward arch of the lower back.

Muscle necrosis: Death of muscle cells, usually due to lack of oxygen or injury.

Palpable: Capable of being touched or felt.

Patellofemoral joint: Joint between the knee cap and the femur (thigh bone).

Paresthesia: An abnormal sensation of the skin, such as numbness, tingling, pricking, burning.

Physical therapy: The provision of healthcare services to people to develop, maintain, and restore maximum movement and functional ability through the lifespan, including for circumstances where movement and function are threatened by injury, disease, or the process of aging.

Physical therapist (physiotherapist): A healthcare specialist who diagnoses and treats individuals who have medical problems or health-related conditions that limit their abilities to move and perform functional activities in their daily lives. Physical therapists help condition muscles and improve levels of activity and functionality through exercise programs.

Plantarflexion: Pointing the foot down at the ankle.

Pronation: Pronation of the hand or forearm refers to rotation of the forearm turning the palm downward. Pronation of the foot involves turning or rotating the foot so that the inner edge of the sole bears the body's weight.

Prophylaxis: The scheduled infusion of clotting factors, usually two to three times a week, in order to prevent future bleeds. The goal is to keep factor levels in the blood high enough to prevent bleeding episodes.

Proprioception: Awareness of the direction, extent, and rate of movement of the joints. This awareness depends upon information sent to the brain from sensory receptors in the joints, tendons, and muscles.

Quadriceps: A large group of muscles at the front of the thigh that extend the knee.

Radio-humeral joint: The elbow joint where flexion and extension of the arm takes place.

Radio-ulnar joint: One of three joints in the elbow, responsible for forearm rotation.

Reflex inhibition: A protective mechanism where a muscle decreases its activity in response to an injury.

Subtalar joint: A joint located between the heel bone and the ankle bone, responsible for the foot's side-to-side motion.

Supination: Supination of the hand refers to turning the palm upward by lateral rotation of the forearm.

Synovium (synovial membrane): The lining of joints, made up of special cells that produce synovial fluid.

Synovectomy: A surgical procedure involving the removal of a portion or all of the synovial membrane.

Talocrural joint: The "true" ankle joint connecting the foot to the shin bone and responsible for the foot's up-and-down motion.

Talus: A bone of the foot that forms the ankle joint.

Target joint: A joint where bleeding occurs repeatedly, and the joint does not return to normal between bleeds.

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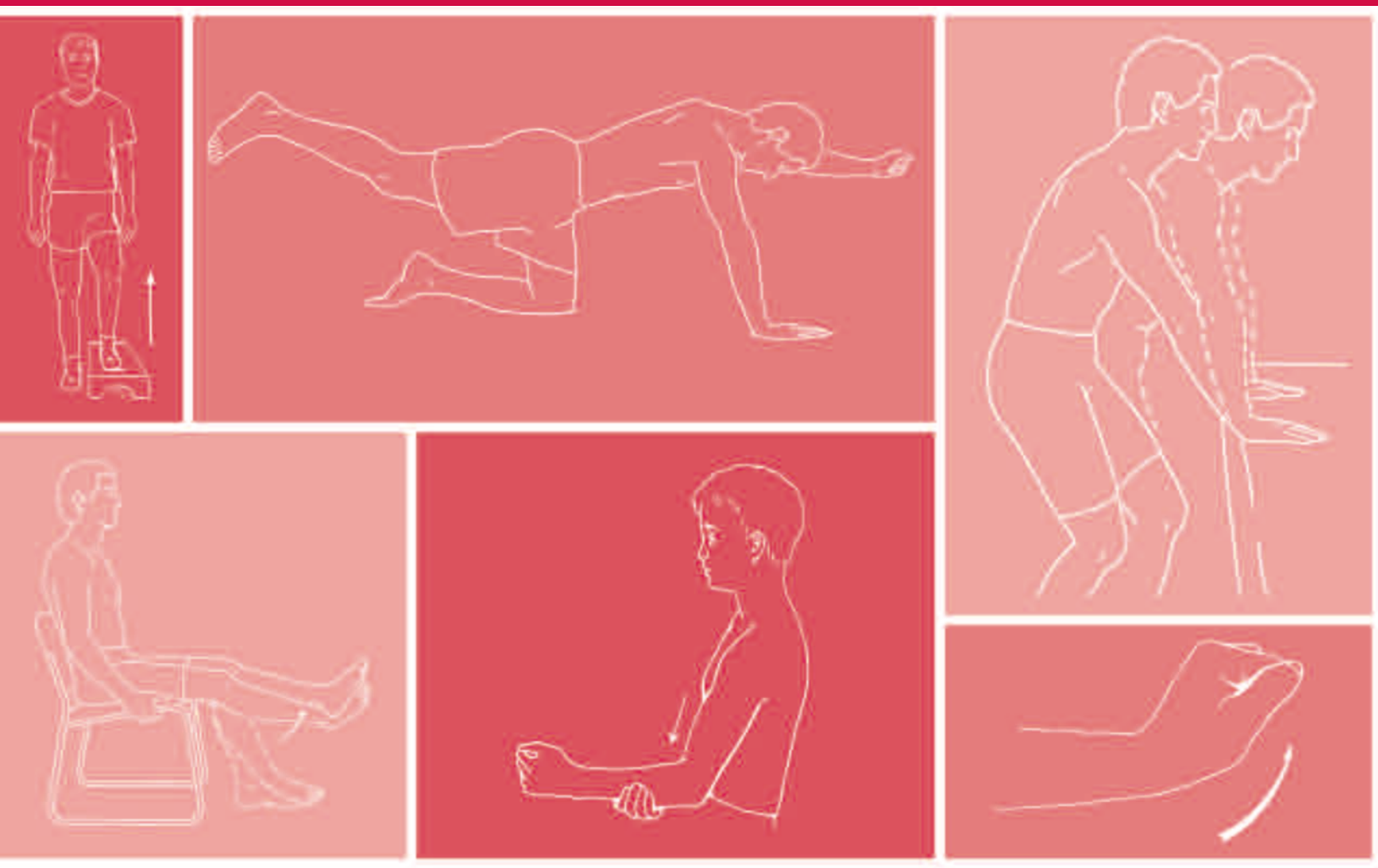

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