Secondary Conditions
Preventions & Treatment:
A Series—No. 5

Joint Problems

The Research and Training Center on Independent Living

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Joint Problems

Everyone uses his or her joints in countless ways during the day. But for people who have become paralyzed from spinal cord injury (SCI) or disease, the joints and the muscles play new and major roles in the injured person's health, movement, well-being, and overall independence.

If a person with SCI has lost most or all of his or her voluntary movements, the joints and the muscles, tendons and ligaments that surround and support the joints can become painful and distorted through disuse or improper positioning. People with SCI who have lower-level injuries and have upper-body movement rely on the joints in their necks, shoulders, elbows, and wrists in different ways. After their injury, their shoulders, arms, and hands become their limbs of locomotion. They use these joints for crutch walking or wheelchair propulsion and for doing all their activities of daily living. They now depend on these joints to keep them as independent as possible.

It's no surprise then that SCI people are concerned and troubled by joint problems that come from misuse, overuse, underuse, and disuse. Joint trouble right after the spinal injury may affect their rate of recovery and rehabilitation. Joint problems may slow their move back home or their return to work. Joint troubles that occur years after their injuries may keep them from performing their daily tasks and may affect their ability to care for themselves. For a person with tetraplegia, formerly called quadriplegia, joint problems may mean pain and discomfort while lying in bed or sitting in a wheelchair for long periods of time with limited movement.

People with SCI also must deal with aging joints and muscles long before they reach their 60s and 70s the years when most people face joint problems. In the United States, most spinal cord injuries occur in people who are 16 to 20 years old.1 People with SCI who are active often start to show joint pain and problems about 15 years after their injuries. So it appears their joints begin to age well before their bodies do. This rapid aging of the joints brings a whole range of problems and concerns for those with SCI: pain control, ease of movement, joint deterioration, and prevention and treatment.

Knowing how the joints work and how to prevent joint problems and pain can help reduce overall discomfort. Knowing about the many ways to treat joint problems once they occur can help those with SCI to remain as active and independent as possible and to live with a minimum amount of pain.

The Body's Joints

Where are they?

The body's joints make movement possible. These connecting points form wherever one bone meets another: where the skull joins the neck, in the jaw, shoulders, elbows, wrists, hips, knees, ankles, and thumbs, and between the many bones in the fingers and toes.

Some joints, such as those in the wrists and ankles let the hands and feet rotate in a full circle. Those in the fingers, toes, knees and elbows act like hinges and let the body bend in only one direction. The ball-and-socket joints in the hips and shoulders allow full rotation where the arms and legs connect to the torso, or body. The joint between the first and second vertebrae in the neck allows the head to move up and down and rotate from side to side.

How do they work?

Healthy joints move freely and without pain. The bones that come together in the various joints are able to move without rubbing because the joint spaces are filled with fluid. They also a protected by cartilage a tough, white fiber that acts as a shock absorber.

In ball-and-socket joints, like those found in the hips and shoulders, the tendons and ligaments hold the bones in place and enable them to move. In the knee and elbow joints, cartilage keeps the bone ends from rubbing against each other. These joints also are protected by spongy fibers that absorb shock and by membranes that secrete fluid into the joint cavity. Strong ligaments, or muscles, hold the joint bones in place and help the bones to move together easily.

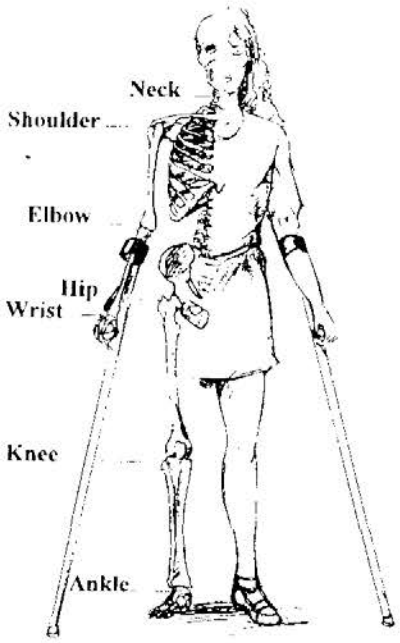
Knee, elbow and shoulder joints also are protected by bursae, saclike cavities that surround the tendons in the areas around the joint. The bursae promote easy, frictionless gliding between the tendons and ligaments. Fluid-filled spaces and tendons keep the fingers and toes moving freely.

How common are joint problems?

According to the National Institutes of Health, problems with muscles and bones the musculoskeletal system that includes all joints are widespread and affect all kinds of people. Conditions involving muscles and bones rank third in the frequency of acute or serious diseases and injury. They are the second highest cause of visits to doctors' offices, the fourth highest cause of hospitalizations, and the third common reason for surgeries in hospitals.2

Among people with SCI, joint problems are frequent and related to a variety of issues such as misuse, overuse, underuse and disuse of joints, muscles, tendons and ligaments. Their joint problems also could be related to diseases or conditions such as osteoporosis and carpal tunnel syndrome, injuries, improper or incomplete care, and aging.

Problem Areas



In people with SCI, any joint that is not moved at least daily through a full range of motion may become a problem joint. Frequent and full joint movement daily promotes health of the fluid-filled, cell-lined joint surfaces and helps keep the joint supple. Stretching movements maintain the flexibility of the ligaments that hold the joint in place and of the tendons and muscles which often get tight and shortened. This tightness limits the joint's full range of motion.

Daily movement can also reduce the loss of bone that leads to osteoporosis. Movement also can stop the development of heterotopic ossification, the condition of developing painful bone deposits in the soft tissues surrounding the joints. This condition can lead to permanent joint stiffness and pain. Full range of movement with gentle stretching offers the best prevention for joint problems and pain.

The joints in the shoulders, elbows, and wrists take the toughest beating and have the most problems. The human

body was designed to move from place to place by using the strong muscles and bones in the legs and hips. Arms and hands were designed for reaching and grasping; they were not designed for locomotion. In people who use wheelchairs, the shoulders, arms, and hands take over the job of the legs and hips. These parts of the body get tired from heavy use. Because they are used so much, they sustain frequent minor injuries and have less time to rest and recover.

Steady use not overuse can make many of the arm and shoulder muscles stronger. The muscles surrounding the elbows, for example, get stronger because these muscles play an important role in the push-up phase of transfers. Although strength helps, it does not fully protect the muscles and joints from overuse.

In fact, most arm pain in people who use wheelchairs and crutches is related to how active they are and how much stress they put on the muscles and joints in their upper limbs. For example, wheelers who play sports or those who push themselves for long distances will have more joint problems. People who must make transfers in places not equipped with grab bars also tend to have more joint pain and injuries caused by twisting and stretching.

Shoulders, Elbows, and Wrists

Just like Atlas, who was forced to carry the world on his shoulders, people using wheelchairs or crutches put the load of their daily lives on their shoulders. It is no surprise then that about 10 to 15 years after spinal cord injury, 70 to 80 percent of wheelchair users with SCI have shoulder problems. After about 20 years, almost all have shoulder problems from overuse and from the muscles and joints wearing down.

Rotator cuff tears in the muscles surrounding the head of the shoulder joint are common shoulder complaints for people who use their crutches to walk and for athletes and non-athlete who use wheelchairs. These people place heavy stress on their shoulders either when using the swing-through gait on their crutches or when propelling their chairs. The muscles that surround the shoulder joint can become overused or misused. This overuse or misuse can lead to tears in the muscles that cover and support the shoulder joint.

In people with tetraplegia that includes high-level spinal injuries shoulder pain also is common. This pain, however, does not come from overuse, but often from immobility and a loss of full motion. It may also result from stretch injuries from improperly assisted transfers and from lying on the shoulders for long periods of time.

So, regardless of the level of spinal cord injury, shoulder pain is a serious and major concern to people with SCI and their most common complaint about their muscles and bones. In addition to shoulder pain or injury, people with paraplegia also encounter problems with the muscles and joints in their wrists and elbows. Just like the shoulders, the elbows and wrists are used heavily, and they begin to hurt when they are overused.

Wrist and elbow problems come from the repetitive strain of using these joints and muscles to propel wheelchairs and to grip crutches. People with SCI also use these joints to bear their weight when they lean on arm rests and table edges for support, and when they grab support bars. The condition known as "tennis elbow" occurs when this overuse causes small tears in the fibers that attach the forearm muscles to the bone. These fibers get inflamed when they are stretched past their level of comfort or when they have to handle too much weight or pressure.

Hips

For people who use wheelchairs, their hips are the major weight-bearing joints. They withstand the pressure of the torso and help a seated person maintain good posture. It is easier for

the shoulders, elbows, and wrists to move properly if a person is sitting upright. So, healthy hip joints are important to people with SCI even if they no longer use their hips for locomotion.

The hip joints in people with SCI can thin out from bone loss and become weaker. Disuse and underuse also can cause the muscles and hip joints to tighten. The extent of these joint changes depends on several things: the level of spinal injury and the person's level of activity.
People with cervical, or high-level spinal injuries tend to have more hip joint problems. People with injuries to the vertebrae in the thoracic or chest area, or in the lumbar or lower back area have fewer hip-joint problems.

The number of hip joint problems appears to be related to activity. People with cervical injuries often are less active than people with lower spinal lesions, and inactive joints are more likely to have problems with stiffness, contractures, and soreness.

Proper support of the pelvis when sitting in a wheelchair also helps reduce stress on the hips that could cause tightness and pain. Proper posture also can prevent scoliosis, or a curving of the spine. Hospitals with SCI centers offer seating clinics that show people how to sit correctly and maintain proper posture and support.

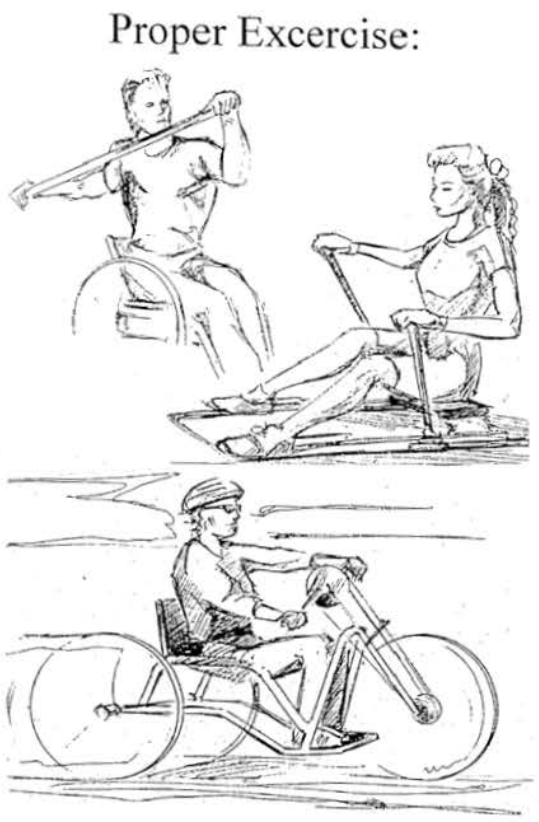
The need for proper sitting posture is attracting more and more attention. Engineers, physical therapists, occupational therapists and seating experts continue to study this important topic. These professional may be able to recommend lumbar poles, specially designed chairs, and special seat inserts to help someone with SCI maintain a healthful posture. Independent Living Centers also may have information on where to find these seating clinics or experts.

Exercises that can be done from a chair or wheelchair also can help people get and maintain good posture.

Many Things Can Cause Joint Problems

Many things can cause pain and problems in the shoulder, elbow and wrist and hip joints and in the muscles, ligaments and tendons that hold the bones in place. The following are among the more common reasons why someone might have problems with his or her joints:

- Inflammation or swelling of the tendons
- Arthritis or inflammation in a joint
- Nerve damage during or after the spinal cord injury
- Muscle, tendon and ligament tears
- Spasticity or muscle spasms that tire the muscles and reduce their ability to support the joint
- Changes in the bursa or capsule surrounding the joint
- Dislocations of the joint and bone fractures
- Improper positioning, transfers, or turning
- Overuse of the muscles
- Contractures or spasticity
- Depression or discouragement
- Frequent pressure on forearms and elbows from leaning or balancing on wheelchair arms, tables and nearby surfaces
- Falls that occur during transfers or crutch walking



Some of these sources of pain, such as damage to nerves, muscles tears, and bone breaks need to be treated by a health- care professional. Others, such as proper positioning, muscle strain, inflammation of the tendons or bursa and overuse can be reduced or handled by the person with SCI or the caregiver.

As with many joint problems, the level of activity appears to be the biggest difference between those who have shoulder problems and those who do not. The level of activity, however, can relate to overuse as well as to underuse.

Overuse can strain and injure the joint area, but underuse or disuse also can cause joint problems. Joints that are not used enough or regularly become stiff and they become contracted or drawn and shriveled. Even the taxing activity of the swing through gait used for walking with crutches can keep joints supple and does not, by itself, appear to harm the shoulder joints.

Studies support the benefits of activity and early and consistent shoulder range of motion exercises to reduce joint pain. Over half of those with shoulder pain noticed it within two weeks of their spinal cord injury. A delay in starting shoulder range of motion exercises until two weeks after the spinal cord injury was a major factor in the person having shoulder pain.

People with SCI also have to adjust to a new image of their bodies. Their bodies no longer look or behave like they did, and they must find new ways to help their bodies perform the tasks of daily living. They may tire more easily at first and experience joint problems and pains as they learn the best ways to move their limbs.

Their many adjustments may make them feel angry or sad, and these feelings may cause them to tighten the muscles in their shoulders, neck and back. This tension can cause pain in these areas and stiffness in these areas. People with SCI can turn to friends, family, a counselor, psychologist, or social worker for help in handling their feelings or the situations that make them feel angry, frustrated or discouraged.

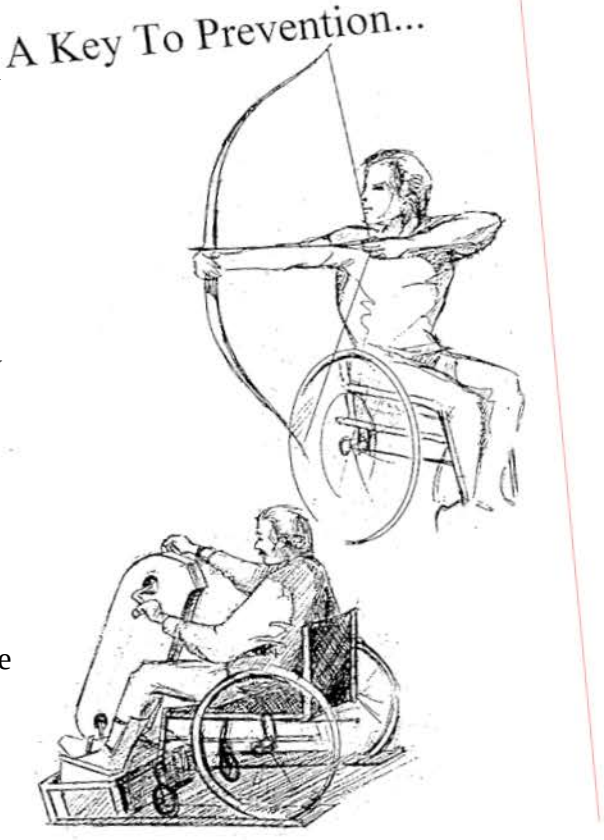
Prevention

Joint pain prevention happens at two important times: soon after the spinal cord injury and later following rehabilitation.

Right after the injury

Moving all the joints as soon after the spinal cord injury as possible reduces the chance of joint pain. Movement is important for everyone who has had a spinal cord injury, but it is really important for people with tetraplegia. People with high-level spinal cord injuries are not able to

move their arms and legs on their own, so they must rely on their caregivers to do passive range of motion on all the joints.



Health care professionals who have worked with spinal cord injuries know that passive range of motion exercises are important. They'll often start these exercises right after the injured person is admitted to the hospital or treatment center. These exercises prevent, control or stop the injured person's joint pain, they ensure joint movement later, and they prevent or lessen contractures and joint deformity.

Those with limited background in spinal cord injuries may not know that it can harm a newly injured person to let him or her lie motionless. The injured person's family may have to intervene on his or her behalf to make sure the person gets quick and proper treatment. The SCI person also should be examined carefully for broken bones or tissue damage inside the joint. These injuries may be hard to detect. If left untreated, however, these injuries will make it harder to move the joints properly.

Motionless joints go through chemical changes. The tissues become contracted they tighten and draw in or shrivel. Tight tissues have less water or lubrication, so they become dry and stiff and harder to move. Contracted joints hurt and they also can become disfigured. Toe and finger joints, for example, will twist and draw in. Range of motion exercises will not work with contracted joints. Once a joint become contracted, it can only be corrected with surgery. But two things must be done to avoid contractures and pain.

First, the joints must receive passive, full range of motion daily. They must be stretched with modest tension, and the stretch must be held for a few moments if necessary. Combining heat with the stretch often helps the joint to move more fully. Many caregivers go through the movements and stretches once a day, but some research suggests doing them at least three times a day for the best results.

Second, joints must be positioned properly. This is particularly true for shoulder joints. When shoulders are positioned correctly, the arms are extended at 90 angles from the body and supported so that they are at the same level as the shoulder. In this position, the injured person's body takes on the shape of a cross. Many studies show that joint pain, especially in the shoulder joints, can be stopped or greatly reduced if full-range of motion and proper positioning are done before the spinal cord injury is two weeks old. Even later, proper positioning can help ease joint pain and discomfort.

After rehabilitation

Once the person with SCI has left the rehabilitation center, he or she must continue to move and stretch the joints that cannot move on their own. A person must maintain a daily schedule of movement and stretches for the rest of his or her life. If the person has tetraplegia, then the person's caregiver must move each joint daily.

If the person has paraplegia, then most likely he or she will learn how to use a wheelchair and will learn how to perform activities of daily living. Doing strengthening exercises to build up the muscles surrounding the joints will help the joints do their jobs more easily.

Wheelchair users also need to work on all their muscles so that no muscle group becomes underused. For example, the shoulder joint is supported and held in place by muscles in the upper arms, those that curve along the top of the joint, and those along the front and back of the joint.

Propelling a wheelchair develops the muscles in the upper arms and across the chest, but not necessarily the muscles that support the shoulder joints along the upper back. If the muscles along the upper back become weaker, they will not be able to hold the joints in the proper position. To work properly, a joint needs even and steady support from all the muscles that surround it. So keeping evenly developed muscles in the chest, arms and upper back will keep the shoulder joint moving properly and will help prevent strain and injury. Equally developed shoulder muscles are one of the best ways to prevent rotator cuff tears.

Some joint stress is good. The stress signals the brain that it needs to build up and strengthen the surrounding muscles. Stress that goes beyond even the abilities of stronger muscles will strain and injure the muscle and the joints. Strained muscles need rest and time to heal.

Wheelers also can prevent joint injury and pain by avoiding tasks that involve more than the normal amount of strength, reach, or rotation. For example, transfers in places that force the person to move over a longer distance than normal can strain the muscles. Muscle strain also can happen if a person has to grip objects that are at the wrong height. Shoulders can be stressed if they are rotated in the wrong way or if they have to withstand more pressure than they are used to. The safest movements for the joints are those that are routine and those that are done slowly and with control.

A physical therapist may suggest arm and shoulder exercises to build up the weaker muscles and to keep heavily used muscles in good condition. An occupational therapist may suggest changes in the living space or the use of assistive devices as a way to reduce repeated injuries.

Tips

People who use wheelchairs can help protect their joints from misuse, overuse and injury by keeping the following tips in mind:

- Keep fit. Daily stretches and exercises will tone muscles and will help joints stay supple. Be sure to exercise all the muscle groups so that the muscles are equally strong.
- Wheelchair athletes may need a higher level of muscle and joint fitness than wheelers whose lives consist of going to work or staying at home and performing regular activities of daily living.
- Wheelchair athletes can learn about proper training and fitness by reading magazines like Sport & Spoke and seeking advice from other wheelchair athletes or trainers.
- Eat a healthful diet that builds strength and controls weight. Extra weight can make it harder for a person to transfer and propel a wheelchair and adds to joint stress.
- Be in good condition before attempting transfers, sports, or distances they are not used to.
- Warm up with a few stretches or range of motion exercises before attempting something that might strain their joints and muscles.
- Make changes in their living space so that work surfaces are at the right height for a person in a wheelchair and that grab bars are in places where they are needed.

- Consider assistive devices such as electric wheelchairs, sliding boards, and wheelchair lifts to reduce the stress on their joints when traveling long distances or when the joints already are strained or tired.
- Listen to their bodies. PAIN, REDNESS OR SWELLING ARE WARNINGS THAT SOMETHING'S WRONG.
- Rest as needed.
- Talk to a physician, physical therapist, or other health-care provider about any joint problems.
- Remember that people have different levels of activity and energy, so they must let their bodies tell them when they need to stop or continue an activity.

Treatments

Before people with SCI can be treated for joint pain, they have to admit they're in pain and then they must be willing to do something about this pain. In one study, about 60 percent of the people in wheelchairs said they felt joint pain when performing their daily activities, but less than half did anything to reduce their discomfort.

Some said the pain wasn't bad enough yet to do anything to stop it. Others thought admitting the pain was a sign of weakness. These people believed they just had to push past the soreness. Few in this group asked for any medical help.

They said they avoided going to a doctor or other health care worker because they thought the suggested treatments would either be steroid injections or surgery. They were afraid to get involved with steroids and they did not think surgery was an option. They did not realize they could do things that would not be as drastic as steroids or surgery.

Simple remedies

Depending on the degree of pain or injury, some people get good results from resting or elevating the joint. Rest often stops the pain in an injured muscle, but too much rest can make a muscle weaker and more prone to injury the next time. Rest cannot be used alone, but must be combined with controlled range of motion and stretching exercises. These gentle movements may bring some discomfort, but in the long run they will help the joint and muscle become stronger and better able to handle strain.

Regular exercise is a simple but excellent way to help joints and muscles keep and stay fit. A routine of exercises or activities that a person enjoys doing each day is a good way to treat and prevent joint and muscle problems and pain.

Hot packs offer another simple treatment for pain. Heat can soothe achy joints and bring a healing blood flow to the area. Ice packs, however, are more helpful if the pain comes directly from an injury, such as a tear. Some people find that relaxation techniques like deep breathing and meditation help them to relax and take their minds off their discomfort.

Change the living space

People who live and work from their wheelchairs perform their tasks at counters and work surfaces designed for people who stand while they work. The shoulders of people in wheelchairs are about 20 inches lower than the shoulders of the people who stand and work. So wheelchair users must lift their shoulders and arms each time they want to do something at a counter or work surface. Lifting the arms so they are straight out, or 90 degrees from the body, stresses the shoulder muscles and joints. If the person holds or lifts something, the stress is even greater.

Lowering kitchen and bathroom counters and sinks will let the arms work at a more natural level and this will help the shoulder joints. Getting tables and work surfaces that are at the right height for a person in a wheelchair also will lessen the amount of stress on the shoulders. One good resource is The Center for Universal Design at North Carolina State University (http://www.design.ncsu.edu:8120/cud/) that helps people with disabilities get information on how to plan, design, remodel, build, and finance changes to their living space.

Equipment and devices

Adapted equipment and assistive devices can help prevent joint and muscle problems. For those who already have pain or stiffness, these devices can reduce the amount of stress on already overused joints and muscles.

Electric wheelchairs, sliding boards, knee braces, electric lifts, standing bars and standing frames, and grasping tools are among the more common items people have seen or used. Arm and wrist splints, if properly fitted and positioned, can relieve stress on the joints and muscles. Each year new equipment and devices appear in the market and many common items are improved.

Newer equipment, such as a standing wheelchair, combines the healthful benefits of a standing frame with the mobility of a wheelchair. Even less technically advanced items can help some common problems. For example, a frame that attaches to the bed and supports the bed covers can help reduce pressure on leg joints and especially toe joints. Toe joints that are contracting some times cannot tolerate even the light pressure from blankets and sheets. Slight changes in clothing also can help. Stockings that contain elastic can help support the legs and reduce swelling in the legs and ankles.

Medications

Joint pain and inflammation can be treated with over-the- counter medications. Some of these medications help just with pain. The types used for arthritis are good for joint pain and inflammation. These would include aspirin products and ibuprofen. People taking any medications should read the product label, follow the directions carefully, and be aware of any side effects. If these medications do not bring relief after a reasonable about of time, a doctor should be consulted. The pain may be caused by muscle tears or other problems that cannot be helped with over-the-counter medications.

Steroids

Steroid or cortisone injections have been used to treat pain in inflamed and swollen joints. The steroid is injected directly into the joint area, and can provide dramatic, but limited results. The pain stops, often for weeks or months. Frequently the beneficial effects of the steroid wears off, and the pain returns. The pain often reoccurs when everyday activity is responsible for the strain and stress on the joints.

Steroids, however, cannot be used routinely. In fact, people usually get only one injection, or two or three at the most over many weeks or months. Prolonged steroid use can have unpleasant and dangerous side effects. Steroid injections into the same joint can damage the joint's surfaces and lead to arthritis or even a weakening and possible later tearing of the tendon.

Steroid injections can reduce pain and the inflammation of the joint and tendons. But the injections do not stop or cure the activity that causes the inflammation and pain in the first place.

Surgery

Surgery is a treatment of last resort and is used infrequently. It may be painful and costly and often requires a longer recovery time. The person always needs physical therapy after surgery. For these reasons, many people avoid or refuse surgery.

Some problems, however, can be helped by and even require surgery. An operation can be the only way to free up and release contracted joints; remove scar tissue; release nerve pressure, as in carpal tunnel syndrome; and repair severe tears in cartilage, tendons and ligaments.

Related Problems

Other conditions or diseases can add to a person's joint pain and problems.

Aging.

The natural process of aging causes the body to stiffen, particularly in the joints. With age, the tough cartilage tissue that protects and cushions the bones thins and becomes less supple. As it thins, the cartilage offers less protection and is less effective at keeping the bones in the joint from rubbing. Thinner cartilage also cannot withstand the pressure from heavy loads. This pressure compresses the cartilage even more, so it offers even less padding.

Tendons and ligaments also become stiffer and weaker with age. They get torn or bruised more easily and it takes them longer to heal. As people age, their muscles tire more easily and cannot provide the support the joint needs.

Light exercises and stretches done daily can help to keep the joints supple. Older people with SCI must be careful not to overdo. Rest breaks and greater use of assistive devices also can help them complete their tasks of daily living and maintain their independence for as long as possible.

Carpal Tunnel Syndrome

Carpal Tunnel Syndrome (CTS) is the most common cause of nerve pain in the hands. CTS occurs when the median nerve and the nine small tendons that run into the hand become trapped in the carpal tunnel. The tunnel is a small space surrounded by the wrist bones and a ligament coming from the palm of the hand. When stress or overuse causes these tendons to swell, they compress and put pressure on the median nerve. This pressure produces pain, burning, numbness and tingling.

People may first feel discomfort in the fingers. Later, they may feel pain in the wrist, hand, forearm and upper arm, and also the neck. Most often the pain occurs at night and shaking the hand helps.

CTS usually happens when a person puts undue stress on the tendons in the tunnel. The stress could come from repeated motions such as typing at a computer keyboard. Repeated extreme bending of the wrist so that the hand goes out at a 90 degree angle also can cause CTS. Doing pressure releases with the hands at a 90 degree angle to the forearm also can cause the tendons to swell. Pressure releases will cause less wrist strain if the person pushes off with the bottoms of hands that have been drawn into a fist.

People with SCI rely on their hands a great deal. They use them to perform their activities of daily living and to propel them in their wheelchairs or with crutches. People with SCI often get carpal tunnel. They may get CTS from assistive devices, such as crutches or hand-held aids that over extend the wrist and put pressure on the hands. CTS can discourage people who rely on assistive devices because their pain is caused by the very items that are meant to help.

The first treatments for CTS include altering the devices or equipment to reduce the stress on the hand. Using wrist splints to immobilize the wrist also relieve the pressure on the carpal tunnel. Non-steroidal anti-inflammatory drugs do not seem to help. So, if the pain persists, steroid injections in combination with properly fitted splints have been tried with some success.

People who continue to stress their wrists, however, do not get long-term relief from injections and often have to consider surgical release of the carpal ligament.

People who use assistive devices must pay close attention to any pain in their fingers and hands. They also should have their nerve function tested to see if CTS is developing. The older the spinal cord injury, the greater the chance the person has or will get CTS. Early detection, even before there is pain, increases the chances of successful treatment.

Heterotopic Ossification

Heterotopic ossification (HO) is the formation of bone where bones usually are not present. Often the deposits form in soft tissues and cause a great deal of pain. A person with HO will have limited or reduced range of motion in the joint, and the joint will swell and may become warm and red. The person also may have some spasticity in the joint area.

HO usually develops below the level of the spinal injury, and in people with SCI it most often affects the hips and knees. It can occur in shoulders, and elbows, but rarely in the hands and feet.

HO is common in people with SCI. Various research studies suggest that as few as 4 percent and as many as 53 percent of people with SCI may develop heterotopic ossification.7,8 The numbers may be higher in people with tetraplegia. Other studies show that about one-fifth of the people with SCI will have some problems with HO.7 Although many people with SCI get these abnormal bone deposits, no one is exactly sure why.

Because HO can limit a person's range of motion, it makes it harder for people with SCI to care for themselves. It also affects their ability to make transfers and to sit in a regular wheelchair. In severe cases, pressure sores may result when joint immobility makes it impossible for the person to position the legs or arms properly.

Recent studies show that HO is more likely to occur in new SCI people who have not started passive range of motion movements soon after their injury. It also occurs in people with SCI who have been immobile and then begin passive range of motion. Passive movements after immobility can stress and even injure the joint areas.

Starting passive movements on paralyzed limbs on the first day of the spinal cord injury seems to be a key to preventing HO. Once HO has developed, however, treatment may not be that successful.

For people with new SCI, a three-month treatment using preventative doses of sodium etidronate or Didronil has been shown to reduce the risk of HO. It is also helpful in treating cases of HO by reducing inflammation and the degree of stiffness and contracture that can occur. Radiation and anti-inflammatory drugs have been used with limited success. In severe cases the bone deposits are removed in surgery, but they have been known to come back.

Osteoporosis

Osteoporosis is a disease that makes bones weak, brittle, and at some risk for fractures. The bone weakens because it is losing its important minerals, like calcium. People who have had a spinal cord injury have osteoporosis within six months of their spinal injury in the bones below the lesion or point of injury. The amount of bone loss can be high.9

In people with paraplegia, the femurs, or the long leg bones are the bones most affected. Osteoporosis in people with paraplegia results from an absence of weight-bearing stress on the bone and a lack of muscle pull on the bone that comes with movement. Without the natural stress from this weight and muscle pull, the calcium leaves the bone. The dissolved calcium also may irritate the kidneys and bladder and can cause infections in the urinary tract.

Bone loss is rapid in the first months after the spinal cord injury, but it becomes much less active in about six months. The bone that is lost most often cannot be regained. So the best treatment for osteoporosis is to prevent as much bone loss as possible. Weight-bearing exercises and movement keep pressure on the bones. Some people may be able to use a standing bar or standing frame and to lift weights. Others may only be able to get into a sitting position. Movement is critical, however, and any movement will work against bone loss.

Researchers are working to find other treatments or methods of care that can help prevent or reverse osteoporosis in people with SCI. These experimental methods include electrical stimulation of the muscles surrounding the bones and injections of hormones and bone minerals. These methods hold some promise, but none has yet been shown to be an effective treatment.

Final Thoughts

Problems with joints and the muscles, tendons, and ligaments that support the joints are common in people with spinal cord injuries. Healthy joints that can move freely and without pain are important to people with SCI. Working joints make it possible for them to perform their tasks of daily living and to remain independent.

With proper care, many joint problems can be avoided or reduced. Problems from misuse, overuse, disuse and underuse often can be avoided. When they do occur, they often can be helped with good professional care or simple remedies like rest, medications, adaptive equipment, and changes in the living space.

Using the information and tips in this booklet should help people with SCI better understand how their joints work and what causes them to become stressed or injured. It should also help them find ways to ease the stress and strain on their joints and maintain their joints' overall health and movement.

Terms You May Hear

Arthritis (ar-thri'-tis) Inflammation of a joint.

Cartilage (car'-tl-ij) The tough, white tissue attached to the joints of bones.

Clavicle (klav'-e-kel A bone that links the back part of the shoulder with the upper part of the rib cage.

Contracture (kon-trak'-churs) Reduced range of motion in the joints caused by a drawing together or shrinking of the tissues surrounded the joint.

Deltoid (del'-toid) A thick muscle shaped like a triangle that covers the shoulder joint and helps to raise the arm.

Heterotopic ossification (het'-er-o-toe-pic os-e-fi-ka'-shun) The development of bone where it normally does not occur, such as in muscle and other soft tissue.

Inflammation (in'-fle-ma-shun) Local heat, redness, swelling and pain that comes from irritation, injury or infection.

Ligament (lig'-e-ment) A band of tough tissue that connects two or more bones or supports organs or muscles.

Muscle (mus'-el) A tissue made up of fibers that can tighten and relax to help the body move.

Musculoskeletal (mus'kye-low-skel-i-tl) Involving the muscles and bones.

Osteoporosis (ah'-stee-o-po-ro-sis) A weakening of the bone caused by a decrease in the bone's minerals, such as calcium.

Paraplegia (par'-a-ple'-je-ah) Damage or loss of movement and feeling to the lower part of the body caused by disease or injury to the nerves within the segments of the spine located in the areas of the chest, lower back, and hips.

Quadriplegia (kwod're-ple-je-ah) Damage or loss of movement and feeling caused by disease or injury to the nerves within the eight cervical segments of the spine that are located in the neck. This term is being replaced by the term tetraplegia.

Steroid (stir'-oid) A natural compound that can include hormones and natural drugs that are used to treat many conditions, including joint pain and swelling, cancer, and allergies.

Synovial fluid (si-no'-vee-el) The clear, watery, stringy liquid that fills the space in the joint cavity where the bones meet.

Tendon (ten'-den) A band of tough, inelastic fiber that connects a muscle with the bone.

Tetraplegia (te'-tra-plee'-je-ah) A term now used internationally to replace the term quadriplegia.

Vertebra (vur'-te-bre) Any one of the bones or segments forming the spinal column. The plural is vertebrae.

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