Hughston Health Alert

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Articular Cartilage Disorders of the Knee

We often hear people say "I tore my knee cartilage." Usually, they mean they have torn the meniscus in their knee. The meniscus is actually not made out of cartilage, but that term is used frequently to describe it. What many people do not realize is that the knee has a large amount of true cartilage, called articular cartilage. This smooth white cartilage, which is about ¼ inch thick, lines and coats the ends of the femur (thigh bone) and tibia (shin bone) in the knee joint (Fig. 1). It creates a smooth, hard surface to keep the bone end from wearing down. It also acts as a shock absorber and distributes loads put on the knee when you stand, walk, or run.

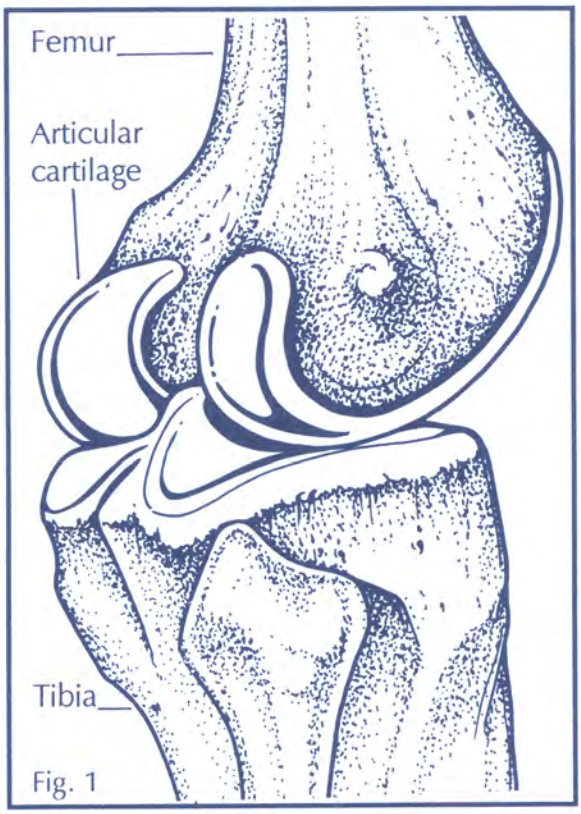

Fig. 1

Microscopically, the structure of articular cartilage is unique. It is made up of protein and water and contains no blood vessels. You are born with as many articular cartilage cells as you will ever have, and these few cells decrease in number as you age. Unlike bone cells which can produce new bone when damaged, damaged cartilage cells do not produce new cartilage. When articular cartilage is damaged, the replacement material produced is not as durable or of the same quality as the original cartilage. The nature of the injury, the age of the individual, and the condition of the joint before the injury affect the quality and durability of the replacement cartilage.

Osteoarthritis

Osteoarthritis is an example of an articular cartilage disease that progresses slowly over time. This common type of arthritis is simply the gradual thinning and wearing down of the articular cartilage. Physicians do not know exactly what causes the degenerative process to begin. The body tries to heal the cartilage, but the process finally fails. Eventually, the cartilage wears down so thin that the bone underneath is exposed. Your knee begins to hurt because there is no cartilage to cushion the bone surfaces when you stand and walk.

To alleviate the pain, physicians prescribe anti-inflammatory medications and exercise. If these methods do not work and only one side of the knee is arthritic, physicians can perform an osteotomy (see "Osteotomies" on p. 2).

Currently, physicians treat advanced cases of osteoarthritis by substituting the thin or lost cartilage with a metal or plastic material in an operation

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called a total knee replacement. For many years, researchers have been trying to develop a substance that can actually make new articular cartilage grow so people will not need a total knee replacement. Unfortunately, the method has not been perfected and will probably not be available in the next 10 years.

Chondral fracture

Older people are not the only ones who can have diseased or injured articular cartilage. Young people can injure their articular cartilage. For example, if you twist your knee badly when participating in sports, you can tear a meniscus or a knee ligament, but you may also fracture the articular cartilage. This injury is called a chondral fracture. When you have a chondral fracture, a piece of the smooth articular cartilage has split from the bone in much the same way as you would peel the rind off of an orange. You may not recall the exact time of injury and may not go to your physician immediately. But when your knee aches, is mildly swollen, and sometimes catches, you will probably want to find out what is wrong. The physician can diagnose a chondral fracture by examining your knee. Also, the physician may take x-rays of your knee. Although cartilage cannot be seen on x-rays, the examiner can see if you have damaged bone. Other methods, such as bone scans and magnetic resonance imaging, might be used to see damage in the joint.

To treat chondral fractures, the physician may do a minor operation using an arthroscope. The physician inserts the arthroscope, or tiny camera, through small skin incisions to see inside the knee joint. Small instruments can be inserted into the knee joint through other small skin incisions to locate the cartilage injury and remove loose flaps of cartilage. In some areas, the physician punctures the bone under the cartilage to cause a small amount of bleeding. The blood helps repair the chondral fracture by forming scar tissue called fibrocartilage. However, the fibrocartilage is not as durable and does not have the same weightbearing and shock absorbing capabilities as the original cartilage.

Chondromalacia

Another type of articular cartilage problem is chondromalacia, in which the cartilage softens and erodes. Physicians do not always know the cause of chondromalacia, but they know that this erosion often occurs when an abnormal amount of pressure is applied to the cartilage — either too much or too little. It is usually not a serious problem; however, when it causes pain, the primary cause of the abnormal pressure should be found and treated.
Chondromalacia may occur from everyday activities or trauma that put pressure on the articular cartilage. It may occur from repeated trauma, such as excessive loading in overweight people, prolonged standing, and prolonged long-distance running. Chondromalacia may also occur from a single trauma, such as ramming your bent knee into the dashboard during an automobile accident.

To treat the underlying problem, the physician prescribes rest, ice or heat, strengthening exercises, anti-inflammatory medication, and avoidance of activities that may irritate and stress the cartilage. If these methods do not work, the physician might look inside the joint with an arthroscope. The physician might not treat the injury surgically if the arthroscopic evaluation shows that chondromalacia is mild. In more advanced cases, the physician may remove some of the damaged cartilage and rebalance the tension of muscles and ligaments around the knee.

Problems with articular cartilage in the knee are common and treatable. We expect to continue making surgical and medical advances in the prevention and treatment of these problems.

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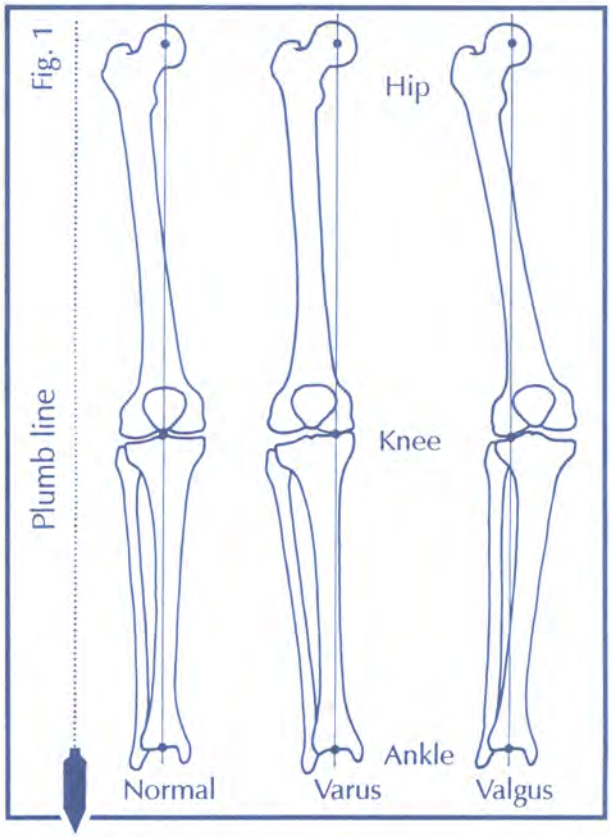


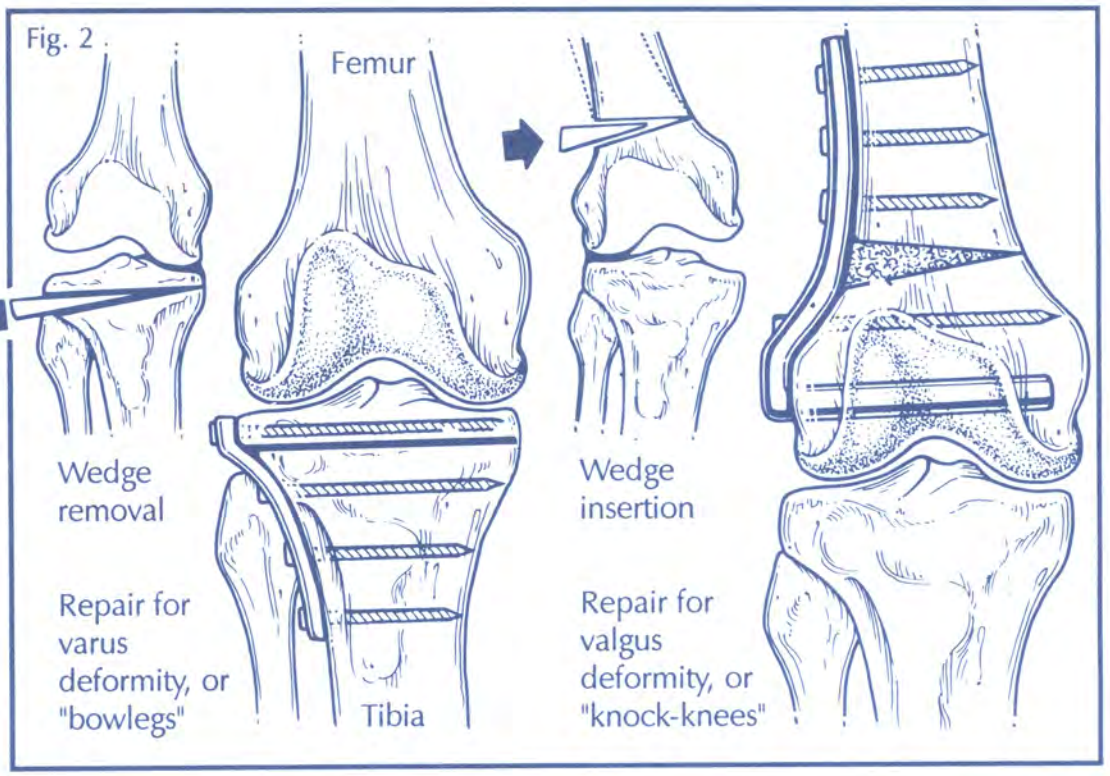
Osteotomies

Straightening Legs to Avoid Replacing Arthritic Knees

Arthritis is an inflammation of the joints that can wear down the cartilage, which lines the ends of bones. Arthritis in your knee can cause your leg to become crooked, or malaligned (Fig. 1). Sometimes the arthritis may be confined to the inner,

or medial, side of the knee and might cause you to develop "bowlegs," or a varus deformity. Conversely, arthritis in the outer, or lateral, side of the knee might cause you to develop "knock-knees," or a valgus deformity.

To find out if arthritis is causing the varus or valgus deformity, your physician takes x-rays of your legs with a plumb line dropped beside them while you are standing (Fig. 1). By studying the "standing" x-rays, the physician can see how your legs are aligned and how much space is in the knee joint. Normally, your legs have a slight valgus alignment, and the centers of the hip, knee, and ankle line up. If the center of the knee is not lined up with the centers of the hip and ankle, the leg is malaligned.



Cartilage does not show up on x-rays, so there appears to be a gap between the tibia (shin bone) and femur (thigh bone) in the knee. If this joint space is narrower than normal on one side, it indicates that the protective cartilage lining the ends of the femur and tibia in the knee is wearing out.

Physicians can successfully treat people with a varus or valgus deformity without replacing their knee with an artificial joint. First, they prescribe exercises and anti-inflammatory medications to relieve the pain and swelling caused by arthritis. Occasionally, an injection of cortisone can help relieve symptoms. But sometimes the pain cannot be stopped with these methods. Persistent pain often indicates too much stress is being placed on the more worn side of the knee when the person stands or walks.

To relieve persistent pain, a physician might realign the leg to shift the excessive forces from the worn side onto the less worn side of the knee. This operation is called an osteotomy, and it involves removing a small section of bone to straighten the leg. This operation can provide long-term relief of pain.

Usually, people who can benefit from an osteotomy are in their 40s or 50s and have a bowlegged, or varus, deformity caused by arthritis. On x-rays, the physician can see that the space on the medial side of the knee joint is not as wide as the space on the lateral side. Also, by studying the path of the plumb line, the physician sees that it touches the medial side of the knee instead of the center. To shift weight off the medial side, the surgeon must do a high tibial osteotomy. The surgeon **removes** a pie-shaped wedge of bone from the lateral side of the tibia (Fig. 2), transforming the leg from a varus to a valgus alignment with the excessive weightbearing forces transferred to the lateral side. The high tibial osteotomy can eliminate or delay the need for a total knee replacement. However, for this procedure to work, the cartilage on the lateral side of the knee joint must not be worn down. If a high tibial osteotomy does not relieve the symptoms, you might need a total knee replacement.

A slightly different type of osteotomy can be done on people who have a valgus deformity caused by arthritis. To shift the weight off the lateral side of the knee, the surgeon **inserts** a pie-shaped wedge of bone into the femur, or thigh bone, just above the knee (Fig. 2). The procedure transforms the leg from a valgus to a varus alignment with excessive weightbearing forces transferred to the medial side.

Arthritis of the knee can cause your leg to become malaligned. However, you can find long-term relief from pain with a joint-preserving osteotomy if the cartilage on only one side of your knee is worn down. That arthritic knee can be made to keep working without the need of a joint replacement.

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Meniscal Injuries

How often have you heard friends or athletes complain that they had "torn cartilage" in their knees? They are probably not talking about the cartilage that covers the end of the bone in the knee. Instead they may have another type of cartilaginous injury: a meniscal tear.

Anatomy

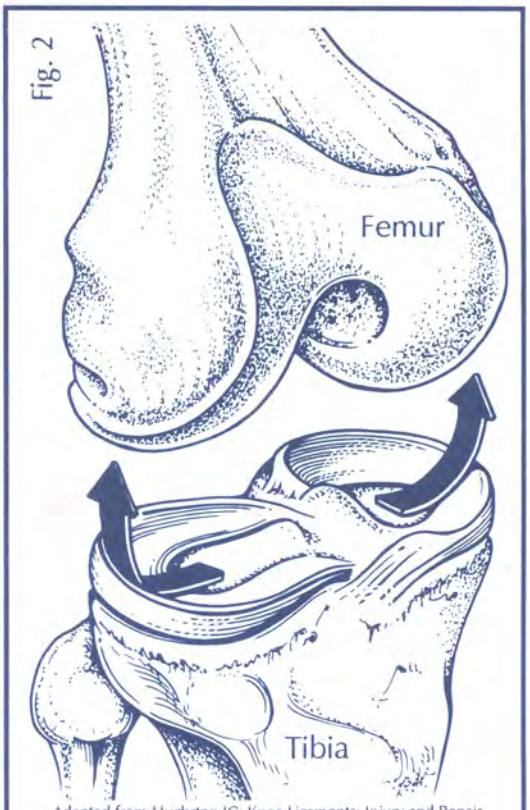
Each knee contains two menisci, one medial and one lateral (Fig. 1). They are fibrocartilaginous disks that act as cushions between the ends of the femur (thigh bone) and the tibia and fibula (lower leg bones). The top of the tibia is flat and the ends, or condyles, of the femur are rounded (Fig. 2). The menisci help make a more concave surface for the condyles to rest and glide on, making the knee joint more stable. The medial meniscus is attached to the ligaments on the back and medial, or inner, side of the knee. Because it is attached so securely, it does not move freely and so it is torn more often than the lateral meniscus, on the outside half of the joint. The lateral meniscus is attached only at the back of the knee and moves more freely as the knee is bent and straightened.

How injury occurs

The menisci can be torn when the knee is twisted suddenly and one or both menisci become trapped between the femur and tibia. They can also be torn when the ligaments in and around the knee are torn. As you age your menisci can lose their rubbery consistency and soften and fray. These weakened structures can be torn more easily, with just a misstep around the house.

When the meniscus tears, you will usually feel a sharp pain on the side of the knee that was injured. The initial pain and swelling will go away, but you might continue to have sharp pain in the knee when turning suddenly. The knee might catch or lock when you bend or straighten it, or you might not be able to bend or straighten the knee all the way.

To diagnose meniscal tears, the physician performs certain tests or maneuvers and asks you to describe the injury and symptoms. X-rays of the knee are usually taken to make sure there is no joint degeneration, loose bodies, or other bone abnormalities. However, the menisci are soft tissue so tears are not visible on plain x-rays. Because meniscal tears show up on magnetic resonance imaging (MRI), the physician can use MRI to accurately confirm the tear if necessary.



Adapted from Hughston JC: Knee Ligaments: Injury and Repair St. Louis: Mosby, 1993; p.15.

Depending on the type and location of the tear and the severity of the symptoms, nonsurgical management can be tried. For meniscal injuries this includes physical therapy to maintain or increase muscle strength and range of motion, activity modification, anti-inflammatory medications, support sleeves, and time. Generally, 1 to 3 months is a reasonable time expectation for significant improvement.

Surgical treatment

Patients who do not improve with the nonsurgical management often need surgery. Most tears are removed or trimmed, but about 10% of recent, or acute, tears can be surgically repaired. Tears that occur in the outer edge of the meniscus have a better chance of healing when repaired than those farther in the joint. The outer

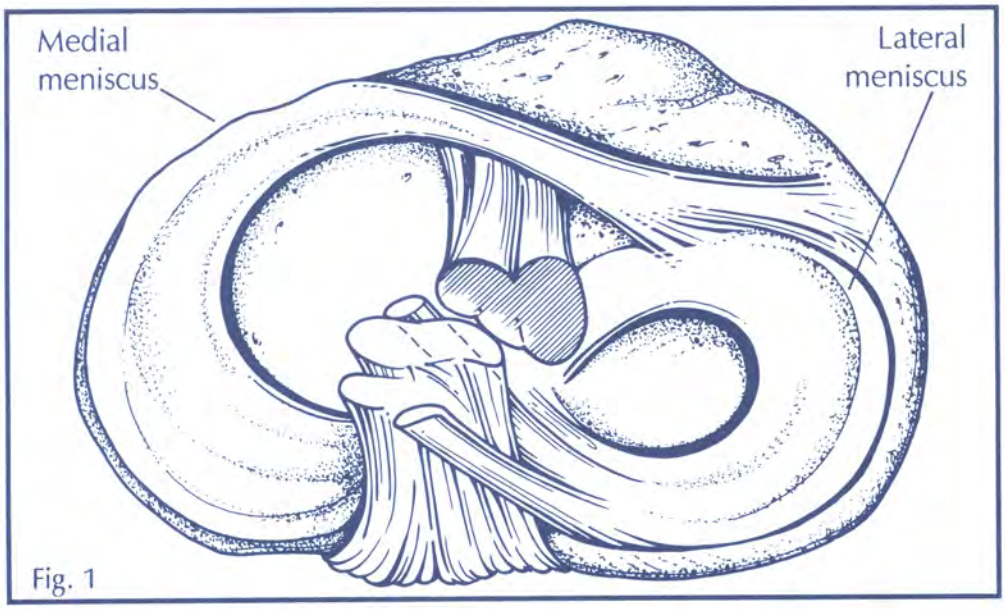


Fig. 1

rim has more blood vessels to help the healing process.

Arthroscopic removal or repair can usually be done as an outpatient procedure in about an hour. The surgeon inserts instruments through two to four small portals, or 1-cm skin incisions. The instruments allow the surgeon to see and treat the torn meniscus. To repair the torn meniscus, the surgeon might need to make a larger incision around the knee. In knees that are unstable because of ligamentous injuries (for example, anterior cruciate ligament tears), the ligaments are repaired along with the meniscus because an unstable knee can cause further meniscal tears or degenerative changes.

Recovery from surgery varies for different people and for different clinical problems. Patients who have a torn meniscus removed or trimmed can expect to use crutches or a walker for 4 to 7 days. They may have some swelling for 3 to 6 weeks and can return to their normal activities in 4 to 6 weeks, if not sooner. If the meniscus has been repaired, weight bearing may be limited with use of crutches for 4 to 6 weeks. This will allow the repaired meniscus to heal. Compared with open knee surgery, with more extensive surgical incisions, arthroscopic surgery causes limited scarring, has a quicker recovery time, and allows a quicker return to work or athletics.

The meniscus plays a key role in cushioning the knee joint and preventing premature arthritis. But if the menisci are torn, painful knee problems can occur that often need to be corrected by surgery. Modern arthroscopic surgery has improved the results of surgery for meniscal injuries and has allowed a quicker return and greater functional recovery for this bothersome condition.

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What Is Wellness?

In the past decade, the idea of being physically fit has become very popular. We all know people who work out at the gym or fitness club. But being physically fit is not all that is needed to be a healthy person. Wellness, or the overall health of a person, has been described as "the constant and deliberate effort to stay healthy and achieve the highest potential for well being." [1]

The ongoing process of wellness requires daily decision making about physical fitness, nutrition, preventive health care, emotional health, weight and stress management, and the nurturing of our spiritual selves. Wellness is a continual balancing of all the elements a person needs to stay healthy and live a longer and better life. The YMCA triangle probably best illustrates this with its concept of spirit, mind, and body.

The spiritual component is the quest for a higher quality of life. It includes your ability to discover and act on your basic purpose in life. The mind component includes emotional and intellectual health. Emotional health is the ability to accept and express your feelings. Intellectual wellness is being able to learn and use information for continued growth as well as being able to deal with new challenges. The body component includes social and physical health. Social wellness is successful interaction with people and the environment, including intimacy with and tolerance of others. Physical health includes cardiovascular fitness, proper nutrition and body fat level, and avoiding the use of tobacco and other drugs. All of these result in an educational process where we learn to be responsible for ourselves and to identify risk factors and change our lifestyles accordingly.

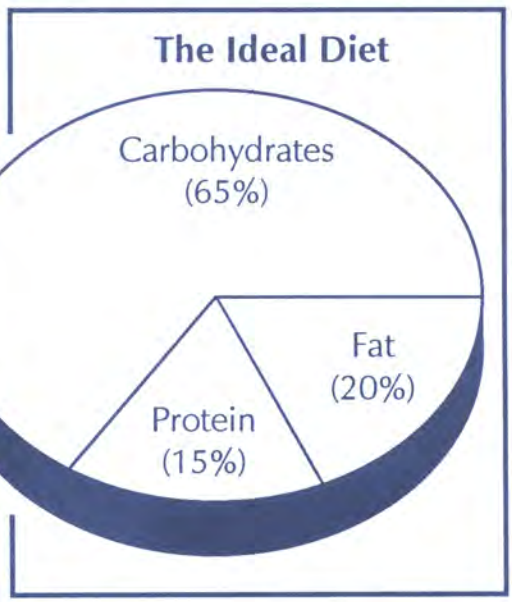
There are several points to remember to help maintain a healthy spirit, mind, and body.

Emotional health

Learn how to handle anger; depression comes from anger and giving in to these negative emotions can take a toll on your physical health. Also, try to use stress to help you be more productive rather than letting it run your life. Use techniques such as effective time management (i.e., schedule important work during the time of day when you feel best and can concentrate well), set priorities, establish realistic goals, and visualize yourself achieving the goals successfully. Give yourself a break by taking time to relax and exercise each day. Don't hesitate to laugh, particularly at yourself, because humor is a great stress reliever. And try to get at least 7 to 8 hours of sleep each night.

Nutrition

Your diet should consist of 15% protein, 20% fat, and 65% complex carbohydrates. Try to reach these levels by eating foods from different groups, i.e., fruits and vegetables and



1. Hoeger WWK. Lifetime Physical Fitness and Wellness. Englewood, CA:Morton Publishing Company, 1986.

whole grains. That way you should get all of the elements your body needs. Avoid snacking between meals, eating too much at mealtime, or eating too much of one food. Eat breakfast regularly; it will give you a renewed source of strength to meet the day so you can handle stress better. Drink plenty of water and avoid highly saturated fats, like animal fats. The ideal body fat for women is 22% to 26% and for men is 16% to 18%. Maintain normal weight and body fat by remaining active.

Exercise

Regular exercise is very important to stay healthy and happy. Not only does exercise make your body stronger and your heart work better, it can actually help you feel happier and deal with negative emotions. You should do some kind of aerobic exercise (e.g., jogging, walking, swimming, cycling, aerobic dance) 3 to 5 days a week. Spend a minimum of 20 to 30 minutes in the activity each time you do it. Always consult your physician before beginning any exercise program.

Preventive health care

As the old saying goes, "an ounce of prevention is worth a pound of cure." Schedule regular appointments with your doctor and dentist. That way you can avoid some problems and catch others early enough for treatment. One of the most important things you can do is watch your cholesterol level. The risk of developing cardiovascular disease is greater for people with total cholesterol over 200. Total cholesterol is determined by adding the level of HDL cholesterol and LDL cholesterol. HDL cholesterol is your good cholesterol, and the higher the number, the better. LDL cholesterol is your bad cholesterol and should be kept at a level of less than 130. Keeping the ratio of your total cholesterol to your good cholesterol as low as possible ensures that you have higher levels of the good cholesterol. Triglycerides are blood fats that exist with cholesterol; these should be kept at or below 100. Often, cholesterol and triglycerides can be controlled through a low fat diet and exercise.

Another preventive measure is to keep your consumption of alcohol to moderate levels or none at all. Moderate consumption has been loosely defined as 6 to 8 ounces of alcohol each week. Alcohol can damage not only your own health, as in liver damage, but also the health of your family relationships. Finally, do not smoke.

Mere knowledge of wellness will not lead to a more healthy lifestyle. You must take information about wellness and use it to make changes in your own life. Any improvements you make in your body, mind, or spirit will result in positive developments in the other components since all three are interrelated. But you must take the first step to make these changes in your lifestyle. Once you become aware of ways to make your life better, they become habits that can increase your life span and improve your quality of life.

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"Wellness ..., the constant and deliberate effort to stay healthy and achieve the highest potential for well being."

NUTRITION

Nutrition and Bone Health

Osteoporosis, or brittle bone disease, affects 90% of women over 75 years of age. Health care providers are constantly investigating the role diet plays in maintaining healthy bones and slowing the effects of osteoporosis.

The calcium factor

Calcium is the most abundant mineral in our bodies; 99% is found in bones. The other 1% is found in blood and body cells and is vital to many body processes. Our bodies release calcium from our bones into the blood and body cells if we do not get enough calcium from our diet. Conversely, our bodies use calcium to form new bone when our diet provides more calcium than the cells need. New bone formation seems to be the key factor in prevention of osteoporosis.

It is important to consume enough calcium during your first 20 to 25 years of life to help build strong bones (Table 1). Bones strengthened while you are young will be better protected against breaks when age-related bone weakening begins. All people between 40 and 45 years of age begin to lose bone strength. In women, this loss accelerates tenfold just before and for 10 years after menopause. Menopausal and postmenopausal women who do not take estrogen supplements need 1200 milligrams of calcium each day from their diets to slow bone loss. A balanced diet should provide the Recommended Daily Allowance (RDA) of calcium, but if you are not consuming enough of this mineral, talk with your physician about taking supplements.

Milk is the best food source for

calcium, not only because it contains almost 300 mg in each 1 cup serving, but because it contains lactose and vitamin D that help your body absorb calcium. As you age, you cannot manufacture vitamin D as well, so you need to consume a diet rich in this vitamin. Foods made from milk, such as yogurt, cheese, pudding, and ice milk, have high calcium contents too. An easy way to boost calcium intake is to add non-fat powdered milk to cooked cereals, breads, sauces, and casserole dishes. Leafy green vegetables such as turnip, collard, and mustard greens contain about 260 mg of calcium in each 1-cup serving. Sardines, clams, and oysters are other good sources of calcium. Two to four servings each day of these high calcium foods along with a balanced diet including dairy products should provide ample calcium.

Flouride increases your body's ability to retain calcium, and it decreases bone demineralization and the incidence of dental cavities. The safest dosage for adults is between 1.5 and 4.0 mg a day.

Inhibiting calcium absorption

Having too much of some minerals and other substances in your diet can affect the way your body absorbs calcium. Diets very high in protein, sodium, and caffeine can cause your body to excrete calcium in urine instead of absorbing it. To promote absorption of calcium, you should limit the amount of protein in your diet to 20% of your total calories each day, or you should increase your calcium intake. Limit the amount of sodium in your diet by decreasing the amount of table salt you add to food. Limit the number of caffeinated beverages you drink and add milk to your coffee to offset the loss of calcium.

Diets very high in fiber, alcohol, oxalates, and phytates inhibit your body's ability to absorb calcium in the gastrointestinal tract. Fiber increases the speed at which the gastrointestinal tract empties, decreasing the time the intestines have to absorb calcium. Also, fiber and calcium may bind and pass out of the body in the stool. Although you should not eliminate fiber from your diet, you should limit your intake to the RDA.

Drinking excessive amounts of alcohol also inhibits intestinal absorption of calcium and reduces bone formation. You cannot offset this loss of calcium by increasing your calcium consumption like you can with protein and caffeine.

Although dark green vegetables, breads, and cereals are high in calcium and are an important part of your diet, do not rely solely on them for your RDA of calcium. Dark green, leafy vegetables contain oxates that bind with that calcium in the gastrointestinal tract, preventing calcium absorption. Breads and cereals contain phytates that inhibit calcium absorption in the intestines.

Table 1

Recommended Daily Calcium Allowance for Females

Nonpregnant, nonlactating women

Age	RDA
1 to 10 years	800 mg
10 to 18 years	1200 mg
19 years to menopause	800 mg

Pregnant or lactating women

Age	RDA
Under 19 years	1600 mg
19 years to menopause	1200 mg

Sticking to the RDA

High doses of vitamins, such as A, C, and D, affect calcium uptake during digestion. A daily diet extremely high in vitamin A or beta-carotene or both might cause bone loss. Sources of vitamin A include liver and beef. Your body converts betacarotene, which is found in dark green, leafy vegetables and dark yellow vegetables, into vitamin A. Also, adding vitamin A supplements to your diet might cause bone loss.

Vitamin C is necessary for formation of bone matrix, or the substance in bone cells that produces new bone. However, there is no solid evidence that it helps your body absorb calcium better. In fact, large doses of vitamin C prevent your body from absorbing calcium.

While vitamin D is important, you should avoid megadoses of vitamin D (10 times the RDA) because high doses can upset your gastrointestinal tract. Through sun exposure and foods rich in vitamin D, you should get an adequate amount of this vitamin. You should not exceed the RDA unless your physician advises differently.

Getting enough calcium

If you are a strict vegetarian, who does not eat meat or dairy products, talk with your physican or registered dietician about taking calcium supplements. You cannot get enough calcium from vegetables alone.

Avoid trying to lose weight on a very low calorie diet. These diets tend to be low in calcium and cause your blood and body cells to take the needed mineral from your bones, increasing your risk for osteoporosis.

The best way to maintain strong healthy bones is a lifetime of good nutrition that includes milk products and other calcium and vitamin D rich foods.

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Ask the Doctor

Q What causes tendinitis and how do you treat it?

A Tendons are cord-like structures that attach muscles to bone. When the muscle controlling a joint contracts, its tendon pulls on the bone, causing the bone to move. With overuse, any tendon can develop tendinitis. Overuse of a tendon means the tendon is stressed or loaded until it cannot endure more strain. Beyond this point, damage occurs. For example, your tendons are strong enough to enable you to hit a tennis ball or run. But, if you do the activity over and over for a long time, your tendons can become so tired and overused that they are injured. Repetition of the activity does not give your body enough time to heal itself, and the tendon becomes inflamed, causing pain.

The goals of treatment are to relieve pain, promote healing, and return a person to normal activities. Brief use of ice and anti-inflammatory medicines helps relieve symptoms. Surgery is the last resort. Rest from the activity that caused tendinitis allows time for natural healing. Range-of-motion exercises and a balanced program of strength training and stretching reconditions damaged tendons so you can return to your normal activities.

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

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Health Hints

- Water is the best beverage to replace lost fluids in active children. Sports drinks are formulated for adults and can have too many calories and too much salt for children.
- If you feel a cold coming on, eat more. Your body needs more calories to fight off the infection.

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