



# Medtronic

## FOR YOUR PACEMAKER

### Patient Manual



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# A COMPANY DEDICATED TO PATIENTS

Medtronic was founded in 1949 by Earl Bakken, a graduate student in electrical engineering, and his brother-in-law, Palmer J. Hermundslie. Today Medtronic is the world leader in medical technology, pioneering therapies that restore health, extend life and alleviate pain.

From its modest beginnings in a 600-square-foot Minneapolis garage, we have transformed Medtronic into a worldwide company that serves customers in more than 120 countries. Each year, millions of patients are treated with Medtronic products and therapies. We invest almost \$500 million each year in research and development, working closely with the

world's leading physicians and scientists to enhance our current products and therapies, and to develop new ones. Although we are a large company, individual patients and their needs are still the driving force behind what we do and how we do it.

Our goal is to improve the quality of your life. This booklet, which provides information about your pacemaker, is one small way we try to help.

Welcome to the Medtronic family. We wish you well.

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# INTRODUCTION

This booklet is about your Medtronic pacemaker and how it restores one of the most vital rhythms of life — the rhythm of your heart.

The most common medical condition needing a heart pacemaker is called “bradycardia,” meaning an abnormally low heart rate that is less than 60 beats per minute during normal daily living activities. People who have low heart rates that cause symptoms often need a pacemaker. A pacemaker stimulates or increases the heart rate to a level that meets the demands of everyday living.

Needing a pacemaker is very common. Since the late 1950s when pacemakers were first successfully placed inside a body, more than 2 million people have

been helped by this remarkable invention. Because of the pacemaker, people with heart rhythm disturbances like yours have returned to a normal way of life.

We hope this booklet will answer many of the questions you have about your Medtronic pacemaker. Your doctor or nurse can provide more details.

As you read through this information, you may find words and terms that are new to you. A list of words and their meanings are located in the Glossary at the back of this booklet.

# 1 THE HUMAN HEART

Before learning why a pacemaker is needed, you should have a clear idea of how the healthy heart functions.

## **The healthy heart and circulatory system**

Your heart is an amazing muscle that is about the size of your fist. It weighs about one pound. It is located behind and slightly to the left of the breastbone.

The heart's powerful muscular contractions (squeezing) are called heartbeats. Each heartbeat circulates blood throughout your body. Your heart pumps about 5 quarts of blood every minute, or 75 gallons of blood every hour. The rhythmic pumping of your heart sends oxygen-rich blood and nourishment to all of your body's cells.

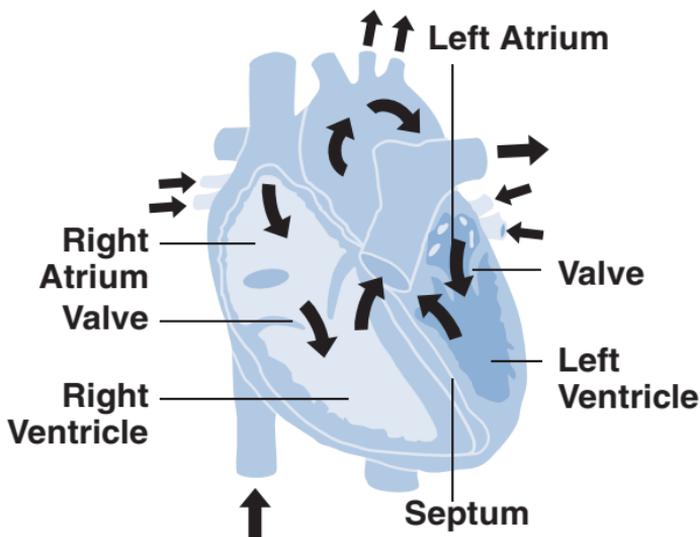
The circulatory system ensures that every cell in your body receives a constant supply of blood. The blood carries nutrients and oxygen to your cells and removes waste products and carbon dioxide.

The heart's pumping action ensures that blood flows constantly throughout your circulatory system. The heart is very sensitive to your body's needs. It has the ability to automatically adjust rate of pumping to meet the stress or activity demands of your body. In a matter of seconds, your heart can increase up to threefold the amount of blood it pumps.

The heart has a muscle wall (septum) that separates it into a left and right side. The left and the right sides are further divided in half (top to bottom). This creates four separate heart

chambers. The two upper chambers are the right atrium and the left atrium. The two lower chambers are the right ventricle and the left ventricle as shown in Figure 1.1. Between each atrium and ventricle is a valve. A heart valve ensures that blood flows only one way.

Blood enters your heart through the atria (plural of atrium). The atria pump blood through the valves and into the ventricles. It is the strong pumping action of the ventricles that pumps the blood to the rest of your body.

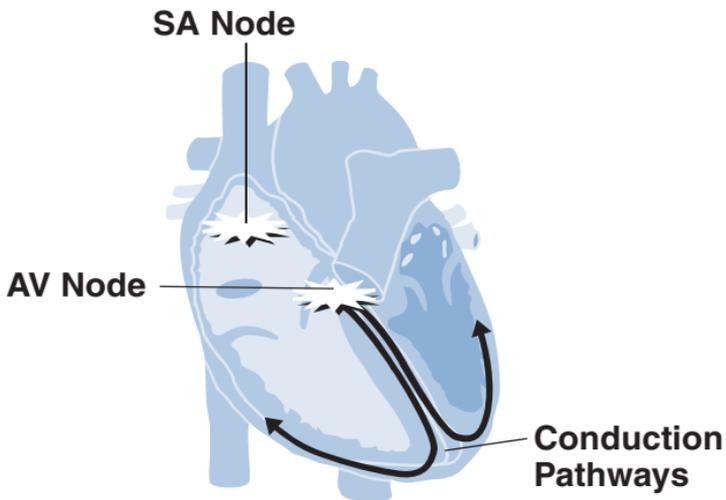


**Figure 1.1** Shows how the blood flows through the heart.

## What makes the heart beat?

Your heart has its own electrical system. This electrical system causes your heart to beat (contract) and controls your heart rate. Special tissues within the right atrium called the sinoatrial, or SA node, typically start

these electrical signals. The electrical signals then travel along pathways throughout your heart, as shown in Figure 1.2.



**Figure 1.2** The healthy heart with a normal electrical conduction system.

## **SA (sinoatrial) or sinus node**

A collection of special tissues called the sinus node is the heart's natural pacemaker. The sinus node sends an electrical signal that causes the atria to contract. The contraction of the atria pumps blood into the ventricles.

## **AV (atrioventricular) node**

This structure passes the electrical signal from the right atrium to the ventricles.

## **Conduction pathways**

These tissue structures are responsible for carrying the electrical signals throughout the heart to the ventricles. Then, the ventricles contract and pump blood out of the heart to the rest of the body.

## Why does a heart beat too slowly?

The most common medical condition needing a pacemaker is called “bradycardia.” This means the heart rate is too slow or irregular to meet the demands of the body during normal daily living activities or exercise.

Symptoms of bradycardia may include dizziness, extreme fatigue, shortness of breath, or fainting spells. Bradycardia often occurs because of a heart rhythm disturbance. These disturbances have many causes. The most common causes are hereditary defects, certain illnesses, some cardiac drugs, the aging process, or the aftermath of a heart attack. Sometimes the precise cause is unknown.

Two types of rhythm disturbances that cause bradycardia symptoms are SA node disease and heart block.

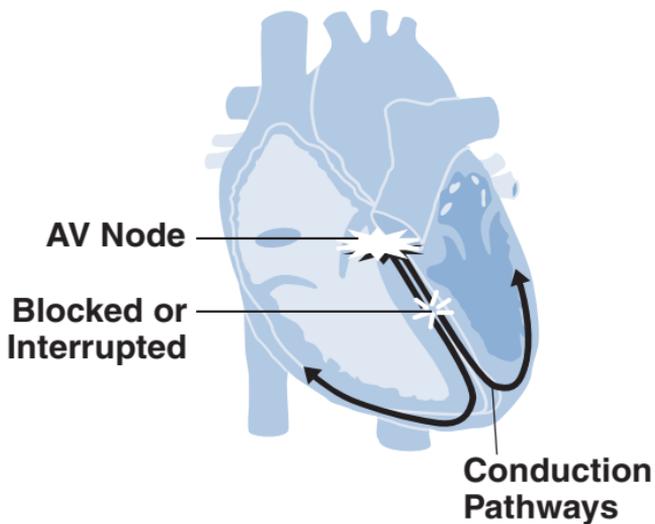
## **Sinoatrial (SA) node disease**

Rhythm disorders of the SA node are described as “sick sinus syndrome.” Sometimes the SA node, your heart’s natural pacemaker, cannot begin a heartbeat or cannot increase the heart rate. When this happens, other tissues in the heart often take over the job of the SA node.

However, the other tissue often cannot maintain a consistent heart rate. Or, the other tissue may create a rate that is too slow or too fast for normal activities. A pacemaker can solve this problem by taking over the job of the SA node.

## Heart block

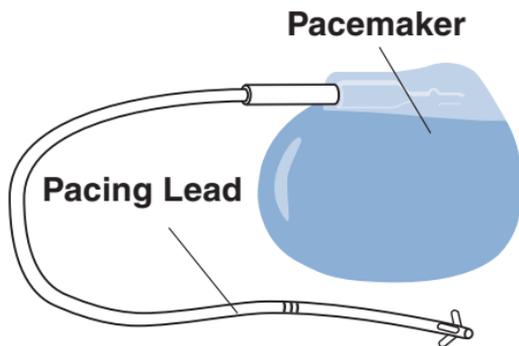
The electrical signal from the SA node must pass through the AV node. The signal then continues through the conduction pathways of the ventricles. At or below the AV node, the electrical signal may become slow or irregular. The signal may even stop. This is called heart block because the electrical impulse is blocked from moving from the atria to the ventricles. Heart block is described as first, second, or third degree. How slow the heart rate becomes depends on the degree of heart block. A pacemaker can take over for an impaired AV node and restore normal heart functioning. Figure 1.3 shows how heart block interrupts the electrical signals to the ventricles.



**Figure 1.3** The electrical signal to the ventricles is interrupted.

## 2 PACING SYSTEMS

Pacemakers relieve symptoms of heart rhythm disturbances. They do this by restoring normal heart rates. A normal heart rate provides your body with the proper amount of blood circulation. This stops the fatigue, dizziness, and shortness of breath caused by bradycardia. It also improves your breathing comfort during normal activities. Figure 2.1 shows a typical pacing system.



**Figure 2.1** A pacing system helps to restore your heart rhythm.

## How does a pacing system work?

A pacing system is made of a pacemaker and a pacing lead. A pacemaker has electronic circuitry and a battery. A pacing lead completes the electrical pathway between the pacemaker and the heart.

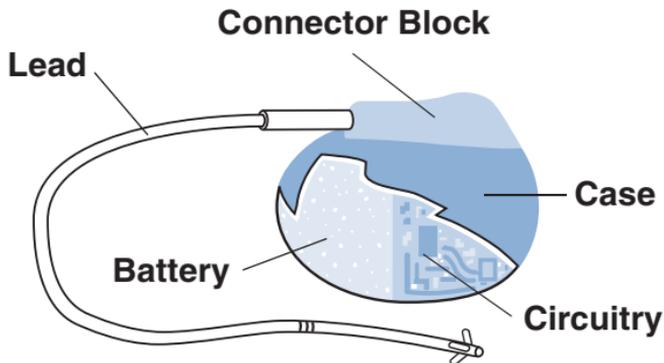
A pacing system performs two vital functions: pacing and sensing.

- Pacing means that a pacemaker sends an electrical impulse to your heart through a pacing lead. This pacing pulse starts a heartbeat. The pacemaker paces the heart when the heart's own rhythm is interrupted, irregular, or too slow.
- A pacemaker will also sense (monitor) the heart's natural electrical activity. When the pacemaker senses a natural heartbeat, it will not deliver a pacing pulse.

A pacemaker relieves the symptoms for most patients. However, pacemakers are not a cure but rather a treatment for underlying heart rhythm disorders. (Pacemakers will not prevent or stop heart disease or prevent heart attacks.)

## **What is a pacemaker?**

A pacemaker is made of a battery and electronic circuitry sealed in a metal case. Figure 2.2 shows the metal case and the connector block into which the lead is inserted.



**Figure 2.2** A pacemaker has a battery, circuitry, connector block, lead, and an outer case.

- **Battery.** The pacemaker battery supplies the power for the pacemaker. The battery is a small, sealed, lithium battery. It typically lasts many years.
- **Circuitry.** The circuitry is a miniature computer inside the pacemaker. The energy from the battery is transformed into tiny electrical pulses. It is the tiny electrical impulses that stimulate the heart to

beat. The circuitry controls the timing and intensity of the electrical impulses delivered to the heart.

- **Case.** The battery and circuitry are sealed inside a metal case (called a can).
- **Connector Block.** The plastic connector, located on top of the pacemaker's metal case, provides the point of connection between the pacemaker and the leads.

## What is a pacing lead?

A pacing lead is an insulated wire that connects to a pacemaker. A pacing lead carries the electrical impulse from the pacemaker to the heart. A pacing lead also relays information about the heart's natural activity back to the pacemaker.

Leads are extremely flexible and strong. The strength and flexibility allow a lead to withstand the twisting and bending caused by body movement and movement of the beating heart.

One or more leads are used. The number of leads depends on the type of pacemaker prescribed by your doctor.

### **How is a pacing lead attached?**

One end of the lead is connected to the pacemaker at the connector block. The other end of the lead is attached to the right ventricle or the right atrium.

A lead can be placed on either the inside or outside wall of the heart. The lead is most often placed inside the heart. This is called an endocardial lead. You may also hear it described as a transvenous lead because the lead is inserted into a vein that leads to a heart

chamber. The tip of the lead (the electrode) is placed against the inner heart wall.

Sometimes, a lead is attached to the outside wall of the heart. This is called an epicardial lead. With this type of lead, an incision is made in the chest. Then the lead is attached to the outer wall of the heart.

## What are the different types of pacing systems?

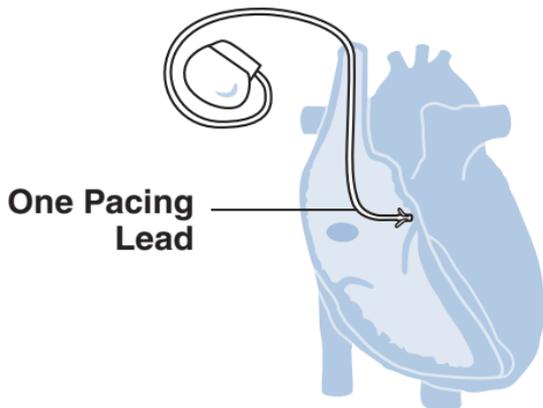
Depending on your heart condition, your doctor will prescribe the number of chambers that need to be “paced”. Pacemakers are designed for either single-chamber or dual-chamber pacing.

### Single-chamber pacing

For single-chamber pacing, either the right atrium or the right ventricle is paced. Only one lead is used.

A lead placed in the right atrium corrects a problem with the heart’s sinoatrial (SA) node. A problem with the SA node is called sick sinus syndrome. With sick sinus syndrome, the SA node does not generate a heart rate that is regular or fast enough for the needs of your body. A pacing lead in the atrium

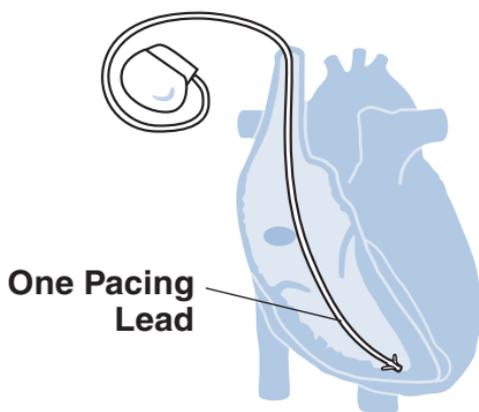
corrects this irregular or slow heart rate. Refer to Figure 2.3.



**Figure 2.3** Single-chamber pacing in the right atrium.

A lead placed in the right ventricle corrects heart block. Heart block also results in a slow or irregular heart rate. With heart block, the electrical signal begins in the atrium but is stopped or slowed at (or below) the atrioventricular (AV) node. Sometimes the electrical signal from the atrium goes through to

the ventricle; sometimes it does not (blocked). A pacemaker lead placed in the ventricle ensures that your heart's ventricles contract with a strong and regular rhythm. A single chamber implant with a lead positioned in the right ventricle is shown in Figure 2.4.



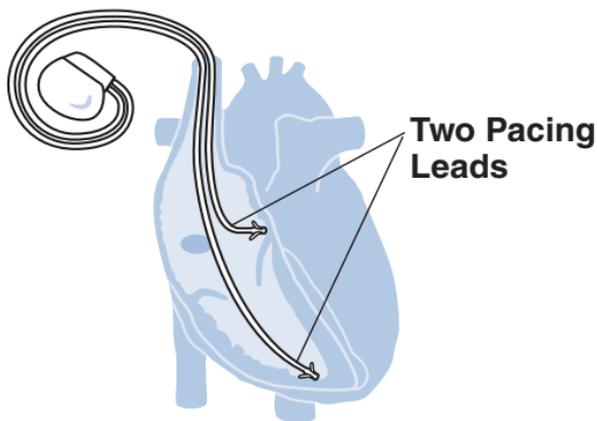
**Figure 2.4** Single-chamber pacing in the right ventricle.

## Dual-chamber pacing

For dual-chamber pacing, both the right atrium and right ventricle of the heart are paced. This typically requires two pacing leads. One lead is placed in the right atrium. Another lead is placed in the right ventricle.

For dual-chamber pacing, the pacemaker senses (monitors) electrical activity in both the atrium and the ventricle. The pacemaker determines whether or not pacing is needed. The pacemaker also ensures that the contraction of the atria is followed closely by a contraction in the ventricles. Dual-chamber pacemakers help the upper and lower chambers of your heart to beat in their natural sequence. Therefore, a paced heart mimics a naturally beating heart. Figure 2.5 shows a dual-chamber

implant with leads positioned in both the right atrium and right ventricle.



**Figure 2.5** Dual-chamber pacing often uses two pacing leads.

## What type of therapies can a pacemaker provide?

### Rate-responsive pacing

Your normal heart rhythm slows down or speeds up many times during the day. The heart beats slower while resting or sleeping; it beats faster in

response to exercise and excitement. Your heart rate changes to supply the blood your body needs during your changing levels of activity.

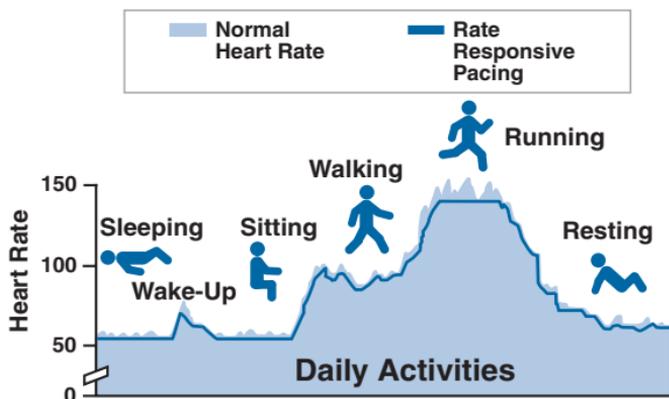
Rate-responsive pacing is needed when your heart cannot adjust its rate to meet the needs of your body. This type of pacing varies its rate depending on your level of activity, respiration, or other factors. Rate-responsive pacing can be part of single-chamber or dual-chamber pacing.

When your heart cannot adjust its rate, a rate-responsive pacemaker uses one or more special sensors. These sensors monitor changes in your body. The pacemaker uses this information to increase or decrease your heart rate.

Variations in pacing rate allow you to perform your everyday activities with ease. If you are walking, exercising, or

gardening, the pacemaker automatically adjusts your heart rate to match your level of activity. When you slow down, rest, or sleep, the rate decreases. The way your heart rate changes is based on the values (programmed settings) chosen by your doctor.

You do not need to engage in strenuous activity to benefit from a rate-responsive pacemaker. The simple act of walking may require a rate of more than 100 beats per minute, as shown in Figure 2.6.



**Figure 2.6** Rate-responsive pacing adjusts the pacing rate according to the needs of your body.

Patients who have rate-responsive pacing report feelings of well-being and the ability to resume active and satisfying lifestyles.

## 3 IDENTIFYING YOUR PACEMAKER

After your surgery, Medtronic provides you with a pacemaker identification (ID) card. Medtronic also assists with registration of your implant.

### **Pacemaker Identification (ID) Card**

The pacemaker identification (ID) card identifies you as the wearer of an implanted device. It is helpful to have this card with you at all times. It is especially helpful for follow-up appointments, to clear airport security, and in case of a medical emergency.

You will receive a temporary ID card during your hospital stay. Four to six weeks after surgery, you will receive a permanent ID card from Medtronic. Your ID card will show the following information:

- Your name, address, and phone number.
- Model and serial numbers of your pacemaker and lead(s) and the date they were implanted.
- Your follow-up doctor's name and phone number.

If you lose your ID card, change doctors, move, or have a new telephone number or area code, you should have a new ID card. To order another card, contact Medtronic Device Registration at the telephone number, address, or Internet site listed on pages 81 and 82.

## Registration

In the United States, a Medtronic pacemaker registration form is completed at the time of your surgery. The information is sent to Medtronic and entered into a patient registry. This

allows Medtronic to notify your doctor of any relevant information about your pacemaker.

If your surgery is done in the United States, the Food and Drug Administration (FDA) Device Tracking Regulation has special rules. It requires that each pacemaker manufacturer have a complete, current, and accurate database containing the registration information.

Medtronic U.S. registration information is confidential. This information must be accurate and current.

The registration information required by the FDA includes the following:

- Model and serial numbers of your pacemaker and lead(s).
- Your name, address, and telephone number.

- Your social security number, if available.
- The date your device was implanted.
- The hospital where the implant was performed.
- The implanting doctor's name, address, and phone number.
- Your follow-up doctor's name, address, and phone number.

**Note:** Your social security number is a key piece of information that helps locate your address if you move.

If you live outside the United States, check with your doctor for the regulations in your country.

## **Change of address or doctor**

If your pacemaker was implanted in the United States, you always need to notify Medtronic Device Registration when you change your address, area code or telephone number, or heart doctor. You must notify Medtronic even if you no longer reside in the United States.

Keeping your records current helps Medtronic notify your doctor of any important information concerning your pacing system.

To change your address or doctor information, contact Medtronic Device Registration at the address, telephone number, or Internet site listed on pages 81 and 82.

## 4 PRECAUTIONS FOR PACEMAKER PATIENTS

### Recovering at home — precautions

After your pacemaker surgery, your doctor or nurse will give you instructions about at-home care.

#### Common instructions

These instructions often include:

- Avoid lifting your arm on the side of the incision for several days after the surgery.
  - ▼ Remember that certain activities, such as playing golf or fly fishing, could cause you to lift your arm.
- Do not put direct pressure on your pacemaker. For example, do not lie face down on, press on, or manipulate (twiddle) your pacemaker.

- Keep your incision clean and dry. (The hospital staff will give you instructions.)
- Check the incision site. If you notice signs of infection such as warmth, soreness, swelling, redness, or discharge, contact your doctor at once.
- Keep all follow-up appointments. For more details, see “Pacemaker follow-up appointments” on page 47. Your follow-up doctor may also advise you about food, medicine, and activities to engage in or avoid.
- **Activities.** Your doctor may restrict certain activities until the incision has healed. Be sure to ask your doctor about the activities in which you may participate.

- **Food.** Your doctor may prescribe that you eat, or avoid eating, certain foods for reasons that benefit your heart.
- **Medicine.** Your doctor may also prescribe medications that will work together with your pacemaker to help your heart beat properly. Make sure you follow your doctor's schedule for taking medications.

## Signs to watch for

Call your doctor if you experience any of the following symptoms:

- Signs of infection at the incision site. Signs include: fever along with redness, swelling, warmth, soreness, or drainage at the surgical scar.
- Anything unusual, such as new unexplained symptoms, or symptoms such as those you had before you received your pacemaker.

- Breathing difficulty.
- Dizziness.
- Fainting spells.
- Persistent weakness or fatigue.
- Chest pain.
- Hiccoughing that is persistent.
- Swelling of legs, ankles, arms, or wrists.
- Intense discomfort.
- Heart palpitations.

## **Resuming activities and exercise**

With your doctor's approval, and as you begin to feel better, you will gradually be able to return to your normal activities. Such activities might include:

- Traveling and driving your car.
- Bathing, showering, swimming.

- Resuming sexual activity.
- Returning to your job.
- Engaging in hobbies or recreation such as walking, hiking, gardening, bowling, golfing, or fishing.

Some people with pacemakers engage in strenuous activities such as jogging, racquetball, and tennis. However, it is important that you follow your doctor's advice. Returning to your daily activities should make you feel better, not worse.

## **Observe the following precautions:**

- Avoid rough physical contact that includes jarring or falling. Avoid skiing and playing football, baseball, and soccer if doing so involves rough physical contact.
- Avoid hunting if a rifle butt is rested on the same side as your pacemaker.
- Avoid any activity that involves pressing on your pacemaker.



## 5 PACEMAKER FOLLOW-UP APPOINTMENTS

An important part of your follow-up care involves checking your pacemaker and lead. You, your doctor, and other medical professionals are involved in monitoring your pacemaker and lead. For the most effective pacing therapy, keep your follow-up appointments with your doctor.

Follow-up appointments allow the many parts of your pacemaker to be checked. This includes checking the pacemaker settings and battery status. The lead is checked by seeing how the pacemaker interacts with your heart.

Your pacemaker and leads are typically checked by having an electrocardiogram (ECG). An ECG records the activity of both your heart and pacemaker. An ECG can be done in the doctor's office, in a clinic, or over the telephone.

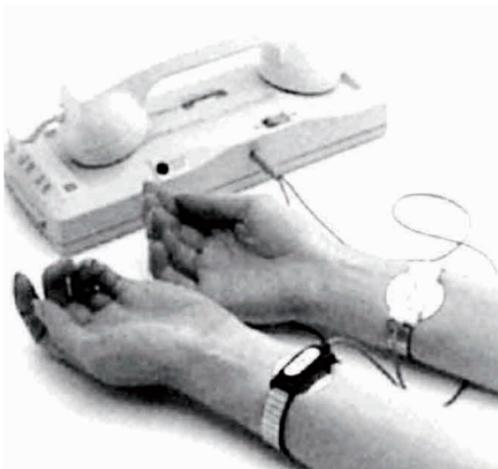
How often your pacemaker and lead need to be checked depends on several factors. These factors include the type of pacemaker and lead, your medical condition, your health plan, and the usual practice of your doctor's office.

The number of times your pacemaker needs to be checked will change

throughout the years. There will be more checks as your pacemaker nears its expected replacement time.

Unlike pacemakers, how long a lead lasts cannot be predicted. Today's leads are designed to last years, but the actual time varies with each patient. Your medical condition, your anatomy, and the surgical technique used when placing the pacing lead affect how long a lead lasts. The best thing you can do is to keep each follow-up appointment. At each follow-up visit, the performance of the pacemaker and lead is checked.

The two basic types of pacemaker monitoring are telephone monitoring and office visits.



## Telephone monitoring

Telephone monitoring offers a convenient way to check your pacing system. Special equipment is used with your telephone to transmit an electrocardiogram (ECG). The transmitter relays your ECG to a receiver and it is recorded. A technician analyzes your ECG. Then the technician sends the information to your doctor.

Talk with your doctor if you are interested in telephone monitoring. Your doctor will prescribe how often you need telephone monitoring and who will provide it. The doctor will also ensure that you have the proper equipment.

Several types of telephone transmitters are available. Your doctor or nurse (or follow-up service) will show you how to use the transmitter you have been given.

Be sure to follow the schedule your doctor has set for you. Generally, you will be called for your ECG transmission. The time and day of the week can be arranged for your convenience.

## Office visits

An office visit usually provides more details about your pacemaker than telephone monitoring does. Your doctor uses these details to thoroughly analyze how your pacemaker is working with your heart.

A detailed office visit is usually scheduled once each year for single-chamber pacemakers and twice per year for dual-chamber pacemakers. Ask your doctor how often you need an office visit.

During an office visit, a programmer is used. A programmer is a small computer. This computer receives information stored in the pacemaker and displays it on a screen for your doctor or clinician to see. It also allows your doctor to change your pacemaker settings in the office - without surgery.

Typically, the following steps are done during the exam.

- **ECG recording.** A clinician attaches ECG electrodes to you. Then an ECG is recorded and analyzed. This may be done using a programmer or a separate ECG monitor.
- **Programmer tasks.** The clinician uses the programmer to perform a number of office visit tasks. Before these tasks can be done, a part of the programmer called the programming “head” is placed over the pacemaker. The clinician begins the following tasks:
  - ▼ **Viewing information.** The clinician uses the programmer to look at information your pacemaker has collected and stored since your last visit. This information is about how your

heart and your pacemaker are working.

- ▼ **Checking programmed settings.** The clinician also checks current pacemaker settings with the programmer. If your lifestyle or medical condition has changed, these settings can be changed using the programmer. If you have a rate-responsive pacemaker, you may be asked to perform some physical activity to check the pacemaker's settings.
- ▼ **Checking the battery.** The status of the battery in your pacemaker can also be checked by using the programmer. How long your battery lasts depends on several factors. Some of these factors include the type of pacemaker you have and the nature of your heart

condition. (When your battery is low, your physician decides when to replace your pacemaker. Because the battery is sealed inside the pacemaker, the entire pacemaker is replaced.)

## 6 GUIDELINES FOR PEOPLE WITH PACEMAKERS

You should be aware of some important recommendations and precautions about electricity and magnets.

Electricity and magnets can be found in medical, home, workplace, and travel environments. For the latest information on precautions for people with implanted devices, see [www.medtronic.com](http://www.medtronic.com).

### **Electricity and magnets**

Tools and equipment that use electricity and magnets have electromagnetic fields around them. These fields are usually weak. Weak fields do not usually affect your pacemaker.

However, strong electromagnetic fields can cause electromagnetic interference

(EMI). EMI may alter temporarily how your pacemaker works.

EMI can stop the pacemaker from sensing your heart's rhythm. This might stop the pacemaker from sending a pacing pulse. EMI could also cause the pacemaker to send a pacing pulse when your heart doesn't need it.

Several safeguards are built into your Medtronic pacemaker to prevent EMI. Electronic filters can tell the difference between natural heartbeat signals and EMI signals. Also, the metal can around the pacemaker shields it from EMI.

If you suspect your pacemaker is being affected by EMI, simply move away from the source of the EMI. Or, turn off the electrical device causing the EMI. Your pacemaker will then return to its normal operation.

Some procedures, activities, and tools may pose EMI risks to pacemakers. Others do not. Refer to these sections for EMI that may be encountered in your daily life:

- Medical Procedure and Equipment Guidelines.
- Home Guidelines.
- Workplace Guidelines.
- Travel and Security System Guidelines.

Contact your doctor or Medtronic (pages 81 and 82) if you have a question about the safety of a tool or situation not included here.

## **Medical procedure and equipment guidelines**

Before undergoing any medical procedure, tell the doctor, dentist, or

technician that you have a pacemaker. They may need to speak with your heart doctor before performing the procedure. This is true especially if the procedure is new or unusual.

Most dental and medical procedures are unlikely to interfere with your pacemaker. However, some procedures may require precautionary measures that prevent or minimize interference.

## Acceptable

As with most medical procedures, the following procedures usually do not interfere with your pacemaker. This presumes that the equipment is used as it was designed and is properly maintained.

- **Dental procedures.** Dental drills, ultrasonic probes to clean teeth, and dental x-rays can be performed. Tell

your dentist you have a pacemaker before beginning any dental procedure.

- **Diagnostic x-rays, including chest x-rays, and mammograms.** If your pacemaker is placed in your upper chest, tell the person performing the mammogram x-ray. He or she can adjust the x-ray equipment to make you more comfortable and lessen the pressure on your pacemaker.

### **Acceptable with precautions**

The following medical procedures may be done when precautions are followed.

- **Computerized axial tomography (CT or CAT) scan.** This is a special type of x-ray equipment that gives a cross-section view. Your doctor can take certain precautions to avoid

affecting the function of your pacemaker.

- **Ultrasound, Diagnostic.** When the transducer is not directly over the pacemaker, this procedure is acceptable.
- **Ultrasound, Therapeutic.** The transducer must be kept 6 inches away from the pacemaker.
- **Electrolysis.** (Used for removal of unwanted hair.) The electrolysis applicator must be kept 6 inches from the pacemaker. If a grounding pad is used, it should also be kept 6 inches from the pacemaker. The grounding pad should be placed on the same side of the pacemaker as the application area.
- **Mechanical ventilation** (used to help breathe during surgery) or

respiration rate monitors (used to check breathing during surgery). If your pacemaker has a sensor that detects changes in breathing, it must be turned off before the surgery.

### **Not recommended under normal circumstances**

Before undergoing any of the following procedures, talk with your regular doctor and your heart doctor. Together, you need to determine the risks versus the benefits. It is possible that the interference can be minimized. Or, your pacemaker can be programmed differently.

- **Electrocautery.** This process stops the bleeding of blood vessels. It is used during most surgeries.

- **Planned external defibrillation.** This procedure may be done to stop a very fast heart rate.
- **Hearing aid with coil around the neck** that sends digital signals using a magnetic field. This type of hearing aid could affect a pacemaker. Before using this type of hearing aid, it must be tested with a pacemaker.
- **Lithotripsy.** This procedure crushes and removes stones. Often these stones are in the gallbladder or urinary tract.
- **Radio frequency ablation.** This process destroys tissue. Sometimes this is done to change the electrical pathway in the heart.
- **Radiation therapy,** depending upon the amount of overall radiation exposure. Often the radiation beam

can be directed around the pacemaker. Or, the pacemaker could be moved to a different location.

- **Transcutaneous Electrical Nerve Stimulation (TENS)**, when used on the torso. This type of treatment uses a hand-held device. It is often used to reduce lower back pain. The hand-held device activates strong electrical currents.

## Not recommended

- **Magnetic Resonance Imaging (MRI)** is not recommended for pacemaker patients. If medical conditions require an MRI, discuss your pacemaker needs with your doctor and heart doctor.

Also, even when the MRI scanner is turned off, it still emits a magnetic field. When you are in or near the

room where an MRI scanner is kept, your pacemaker may be affected.

- **Diathermy.** This process heats body tissue. The heat may be created using an electrical field. It may be used during a chiropractic session.

People with metal implants such as pacemakers, implantable cardioverter defibrillators (ICDs), and accompanying leads should not receive diathermy treatment. The interaction between the implant and diathermy can cause tissue damage, fibrillation, or damage to the device components, which could result in serious injury, loss of therapy, and/or the need to reprogram or replace the device.

## Home guidelines

People with pacemakers can do most daily activities. This section offers guidelines about telephones, household appliances, and home power tools.

In general, keep AC-powered, hand-held devices several inches away from your pacemaker. This will reduce the possibility of EMI.

### Telephones

#### Acceptable

- **Corded home and public phones**

#### Acceptable with precautions

- **Handheld cellular, mobile, or cordless phone (wireless phones)**

You can use mobile phones (including cellular phones and other wireless phones). However,

mobile phones may cause electrical interference with your pacemaker when the phone is turned on and held too close to your pacemaker. Any effect is temporary, and simply moving the phone away will return the pacemaker to its previous state of operation.

To avoid any possible interference between mobile phones and your pacemaker, keep all mobile phones at least 6 inches away from your pacemaker. When using a mobile phone, hold it to the ear that is farthest away from your pacemaker. Also, do not carry a mobile phone close to your pacemaker, such as in a shirt pocket (or in a pants pocket if your pacemaker is implanted in your abdomen).

## General household items

Your Medtronic pacemaker has built-in safety features. These features protect it from electromagnetic fields created by common household appliances and light office equipment. The following items are safe to use:

### Acceptable

- Electric blankets, heating pads, and portable space heaters.
- Hand-held items without an AC motor such as cordless electric knives, irons, and newer cordless shavers.
- Large appliances including washers, dryers, and electric stoves.
- Ovens including microwave, gas, and electric.
- Salon hair dryers.

- Tabletop appliances such as toasters, blenders, electric can openers, and food processors.
- Televisions, FM and AM radios, video cassette recorders (VCRs), video games, compact disc (CD) players, stereos (other than speakers), desktop and laptop computers.
- Treadmills.
- Vacuum cleaners and electric brooms.

### **Acceptable when 6 inches away**

The following items can be used when they are kept 6 inches away from your pacemaker. (It is usually the motor that may cause an electromagnetic field.)

If you experience dizziness or palpitations, simply move further away

from the item. Your pacemaker will then operate properly.

- Hand-held hair dryers and older shavers with an electrical cord.
- Pagers.
- Sewing machines and sergers (sewing machines that overcast edges to prevent fraying).
- Electric toothbrush and the base charger of an ultrasonic toothbrush.

- Large stereo speakers which often have large magnets. Do not lift large stereo speakers close to your pacemaker.

### **Use only when 2 feet away**

- When using an induction range for cooking, keep your pacemaker 2 feet from the range to prevent EMI.

### **Home power tools**

Most home power tools are safe to use, according to the following guidelines:

- Keep hand-held motorized tools away from your pacemaker.
- Keep all equipment in good condition to avoid electrical shock.
- Avoid operating power tools when you are alone.

- Be certain that tools are properly grounded. If you use power machinery often, a ground-fault-interrupt outlet is a good safety measure. This inexpensive device prevents a sustained electrical shock.

## Acceptable

It is safe to use electric yard tools. Included are the following tools:

- Electric hedge clippers
- Leaf blowers
- Lawn mowers
- Snow blowers

Battery-operated tools and most electric tools are also acceptable to use. Included are these tools:

- Power drills

- Jigsaws
- Electric screwdrivers
- Soldering irons (but not soldering guns)

### Acceptable with precautions

- **Gas-powered tools.** Turn off the engine before making adjustments.
- **Car engine repair.** Use caution when near the coil, distributor, or spark plug cables of a running engine. Turn off the engine before making any adjustments to the distributor.
- **Soldering guns and demagnetizers.** Keep 6 inches away from your pacemaker.

## Not recommended

**Avoid using a power tool locked in the “on” position.** This would prevent you from quickly turning off the equipment.

**Avoid using a gas-powered chain saw.** This is recommended because your hands and body come into close contact with the electric spark-generating components. These components could interact with your pacemaker.

## Workplace guidelines

After recovering from surgery, most patients can return to work or school. This section offers precautions and guidelines about using (or working near) various kinds of equipment or sources of high electrical current.

## Acceptable

Most office equipment is safe to use with your pacemaker. This includes the following items and other similar equipment.

- Computers such as desktop, laptop and mainframe.
- Copy machines.
- Electric typewriters.
- Facsimile (fax) machines.
- Modems.
- Printers such as laser and dot-matrix.

## Acceptable with precautions

The antenna used with citizen band (CB), amateur radios, and other radio transmitters can produce EMI. The distance to maintain from the antenna

and your pacemaker depends on many factors.

These factors include the transmitter power, frequency, and type of antenna. The distances shown in the chart that follows should avoid EMI. However, if the transmitter power is very high, longer distances may be needed. And, if the antenna can be directed very specifically, you may also need to be farther away.

<b>Type of CB, amateur, or other radio transmitter</b>	<b>Minimum distance between the antenna and your pacemaker</b>
Portable	1 foot
Car	3 feet
Home	10 feet

## Not recommended

Heavy electrical or industrial equipment often produces EMI. This equipment may affect how your pacemaker works. Check with your doctor before working with the following equipment.

- Dielectric heaters, used in industry to bend plastic.
- Electric arc welding equipment.
- Electric steel furnaces used in factories.
- Induction furnaces such as kilns.
- Industrial magnets.
- Large magnets, such as those used in some stereo speakers.
- Power plants, large generators, transmission lines, and transmission buildings.

- Radio and television broadcasting towers.

## Travel and security system guidelines

Support for patients with Medtronic pacing devices is available throughout the world. Visit the travel pages of the Medtronic web site at <http://www.medtronic.com> for more information.

### Acceptable

The following devices do not affect your pacemaker. However, you may wish to know about these devices before you encounter them.

- **Automobiles.** A car seat belt may feel uncomfortable. On newer model cars, the seat belts can be arranged for your comfort. Placing a soft towel between the seat belt and the

pacemaker during the first few weeks after surgery may cushion the area. In any case, seat belts should be worn at all times.

- **Airport security systems.** Identify yourself as having a pacemaker. Your pacemaker will not be affected by the security system. However, the metal case around your pacemaker could set off the metal detection alarm.

To clear airport security, show your pacemaker ID card. Request a hand-held screening device to clear you through the security system.

- **Home security systems.** It is unlikely that your pacemaker will set off or be affected by home security systems.

## Acceptable with precautions

- **Retail and library security systems.** To prevent the effects of these systems on your pacemaker, just walk normally through them. Do not linger near or lean against these detectors.

It is unlikely that your pacemaker will set off retail or library security systems. However, always carry your pacemaker ID card. This card is helpful should your pacemaker set off a metal detector or security system.

- **Other electrical devices.** Do not stand close to any electrical device if you suspect it is causing a problem with your pacemaker.

## 7 FOR MORE INFORMATION

This booklet explains the basic functioning of your pacemaker. It also provides many guidelines.

If you have questions not addressed in this booklet, ask your doctor or cardiac nurse. If you live in the United States and have non-medical questions, you may contact Medtronic:

1-800-551-5544

Monday through Friday

7:00 AM to 6:00 PM (Central Time)

Medtronic, Inc.

Patient Services Department

Mail Stop MVS 14

8200 Coral Sea Street NE

Mounds View, MN 55112

Fax: 763-367-5809

For addresses and telephone numbers outside the United States, see the back cover of this booklet.

## **Newsletter for people residing in the United States**

Medtronic publishes a newsletter called *Rhythms of Life*. This newsletter contains educational articles and patient stories. Contact Patient Services if you wish to receive the newsletter by mail. Or, you can read the newsletter on the Medtronic Internet site.

## **Patient information on the Internet**

The Medtronic Internet site contains information for patients. To locate the site, connect to the following address:

<http://www.medtronic.com>

Follow the links for patients and their families and for pacemakers.

Like this booklet, the site contains information about the heart, pacemakers, surgery and recovery, and EMI guidelines. It also contains answers to frequently asked questions, a glossary of medical terms, and the *Rhythms of Life* newsletter.

If you move, change telephone numbers, or change doctors, you can inform Medtronic Device Registration of the change through the Internet, by postal mail, or by telephone.

## 8 A SUMMARY OF YOUR RESPONSIBILITIES

After a while, you may forget that you even have a pacemaker. However, you need to be aware of several topics. These topics have been described in this booklet. For your convenience, a few main points are summarized below.

### **When to call your doctor immediately**

Watch for physical signs that may indicate your pacemaker and medical condition need to be checked. Call your doctor immediately if any of these symptoms occur:

- Difficulty in breathing, dizziness, or fainting spells.
- Swelling of the legs, ankles, arms, or wrists.

- Chest pain or prolonged hiccupping.
- Fever along with redness, warmth, soreness, swelling, or drainage at the surgical scar.
- Unusual heart rate increases or palpitations.

Other instructions about at-home-care are described on pages 41-46.

## **About your doctor**

Visit your doctor or pacemaker clinic regularly for follow-up visits and other check-ups. Follow your doctor's schedule for telephone follow-up of your pacemaker, if this has been prescribed for you.

Follow your doctor's instructions about diet, medications, and physical activity.

Tell any new doctor, dentist, or other health professional that you have a pacemaker.

## **Electromagnetic Interference (EMI)**

If you suspect interference with your pacemaker, simply move away from the source of the interference. The pacemaker will resume normal operation. Your pacemaker will not be permanently affected. This is explained more completely on pages 56-80.

## **Identification (ID) Card**

If you move, change your telephone number, or change doctors, notify Medtronic Device Registration immediately at 1-800-551-5544.

Carry your identification card with you at all times. This card is described on pages 36-40.

## 9 GLOSSARY

**arrhythmia** – An irregular heartbeat. This could be a rhythm that's abnormally slow (bradycardia) or a rhythm that's too fast (tachycardia or tachyarrhythmia).

**atrium (plural = atria)** – The two upper chambers of the heart. These are called the left atrium and the right atrium.

**AV node** – The area within the heart's electrical system that conducts electrical signals received from the atria to the ventricles. Also called the atrioventricular node.

**AV valves** – The AV valves are located between the atria and the ventricles. Also called atrioventricular valves.

**bradycardia (pronounced bray-d-card-ee-ah)** – A type of heart condition in which the heart beats abnormally slow at less than 60 beats per minute. This may be too slow or irregular to meet the body's demands.

**dual-chamber pacemaker** – A type of pacemaker that typically requires two pacing leads. One lead is placed in the right atrium. The other lead is placed in the right ventricle.

**dual-chamber pacing** – A type of pacing in which both atrial and ventricular activity are sensed by the pacemaker. This sensing (or monitoring) determines when pacing is needed. When pacing is needed, a pace into the atrium is followed closely by a ventricular pace. This timing mimics the heart's natural activity.

**ECG** – An electrocardiogram is a line drawing of the heart's electrical activity.

**electrode (of a pacing lead)** – The part of a lead from which a pacing pulse is delivered into the heart. An electrode may also relay information about the heart's electrical activity to the pacemaker. A lead may have one or more electrodes.

**electromagnetic interference (EMI)** – Fields of energy around certain types of equipment that use electricity and magnets. Weak EMI does not affect pacemakers. Strong EMI often affects how a pacemaker works.

**endocardial lead** – A pacing lead threaded through a vein and placed inside the heart. Also called a transvenous lead.

**epicardial lead** – A pacing lead attached to the outside surface of the heart. May also be called a myocardial lead.

**heart block** – A medical condition resulting when the AV node is blocked from sending electrical signals to the ventricles. Often noted as 1st, 2nd, or 3rd degree.

**heart rate** – The number of times that the heart beats in a minute. A normal heart rate increases and decreases, depending on a person's activity level and is typically in the range of 60-100 beats per minute (bpm).

**myocardial lead** – See epicardial lead.

**pacemaker, artificial** – An implanted medical device that restores the heartbeat to a more normal rate.

A pacemaker stimulates the heart muscle with precisely timed discharges of electricity. These very small amounts of electricity cause the heart to mimic a naturally occurring heart rhythm.

**pacemaker, natural** – See SA node.

**pacing lead** – A flexible, insulated wire. It is part of a pacing system. A pacing lead delivers the pacemaker's electrical pulse to the heart. The lead may also relay information about the heart's natural activity back to the pacemaker.

**programmer** – A small computer used in a clinician's office to check and reprogram the pacemaker.

**pulse generator** – Another name for a pacemaker.

**rate-responsive pacemaker** – A type of pacemaker with one or more special sensors. These sensors recognize

changes in the body, such as movement of the body or respiration rate (breathing).

**rate-responsive pacing** – A type of pacing in which the pacing rate varies to meet the body's changing needs.

**SA node** – Also called the sinoatrial or sinus node. The SA node is the heart's natural pacemaker. It is located in the upper right chamber of the heart (right atrium). A properly working SA node produces small electrical impulses that vary in rate. The rate depends upon the body's demands for oxygen.

**SA node disease** – See sick sinus syndrome.

**sick sinus syndrome** – A rhythm disorder of the SA node.

**single-chamber pacemaker** – A type of pacemaker in which one lead is

connected to either the right atrium or the right ventricle.

**single-chamber pacing** – A type of pacing in which only one heart chamber is paced. Most often, the right ventricle is paced.

**tachycardia (pronounced tack-ee-card-ee-ah)** – A heart rhythm that is abnormally too fast. The heart pumps quickly but inefficiently.

**telephone monitoring** – A kind of pacemaker follow-up method. An ECG of the patient's rhythm is sent to another location using a special telephone transmitter.

**transvenous lead** – See endocardial lead.

**ventricles** – The two lower chambers of the human heart. These are called the left and the right ventricle.



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*Alleviating Pain · Restoring Health · Extending Life*

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