

▲Electrical stimulation

Electrical stimulation of the pelvic floor may be effective therapy both for stress incontinence and urge incontinence.(63-67) While urge incontinence is treated by short-term maximal stimulation,(66,67) stress incontinence is usually treated by long-term stimulation of lower intensity.(63,64)

Eriksen & Eik-Nes treated 55 stress incontinent women awaiting surgical repair. After therapy 68% were continent or had improved so much that the operation was cancelled. At two-year follow-up success was maintained in 56%.(63) In a randomized placebo-controlled trial electrical stimulation for stress incontinence proved superior to a sham device, both for objective and subjective parameters.(65) Another study showed electrical stimulation and pelvic floor exercises to be equally effective in the treatment of stress incontinence.(64)

Eriksen et al. also treated 48 women with urge incontinence. Clinical and urodynamic cures were obtained in 50% and a significant improvement in 33%. At one-year follow-up a persisting positive effect was found in 77%.(66) In a Swedish study 63% were cured or had improved significantly.(67) Both studies were done without control groups. So far, no controlled study has been published on the effect of electrical stimulation in urge incontinence.

Since 1992 the Norwegian National Insurance has reimbursed the cost of electrical stimulators for home treatment of female UI. An evaluation report was produced after two years. Approximately one third of the patients were cured or substantially improved. Treatment effect was not dependent on the doctor's status (general practitioner v. specialist), but the effect correlated significantly with patient compliance. Ten per cent found the treatment difficult to accomplish.(68) Close follow-up and motivation for use seem to be necessary for successful electrical stimulation at home.(63,68) This aspect is probably illustrated by the lower success rates found in this unselected general survey(68) compared with the clinical trials.(63-67)

Understanding Electrical Stimulation

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The use of electrical stimulation (ES) for the treatment of urinary and fecal incontinence and other related problems such as interstitial cystitis spans a 30-year period. ES is a very popular treatment modality outside the US but only over the past 5 years has this treatment become part of US medical practice for these conditions.

Background of Important Terms and Concepts of Electricity

To understand the use of ES it is important to understand principles for using electricity. Current is defined as the flow of electrical charge from one point to another. In the body, current is a flow of ions, mainly chloride (CL⁻), sodium (Na⁺), and potassium (K⁺). During electrical stimulation, charge (ions) moves from one point to another. This transfer of charge (ions) causes physiologic changes to occur and in this case the physiologic changes occur in the pelvic floor and bladder muscles.

There are 3 types of current:

1. Direct
2. Alternating
3. Pulsed - (this is the type most commonly used in ES of the pelvic floor muscle or bladder). Pulsed current is the flow of charged particles either in one direction or in two directions that stops at regular intervals before flowing again. The two types of pulsed current are:
 - a. Current passes in same direction, which can result in skin/tissue irritation.
 - b. Bi-directional – biphasic is when particles move in one direction, according to their charge, fall briefly to zero, and then reverse direction.

Most ES of the pelvic floor muscle or bladder is biphasic in nature to reduce the chance of skin irritation because the ions are flowing more evenly.

Electrical stimulation is often referred to as *pelvic floor muscle electrical stimulation* (PFES) or *functional ES*. PFES is the application of electrical current to the pelvic floor muscle. PFES combined with biofeedback may prove useful in that the electrical stimulation provides a passive contraction that increases awareness of pelvic floor muscle contractions in general. Applying a low grade electrical current to pelvic floor muscles stimulates the pelvic muscle to contract. Muscle contraction from PFES is a useful addition to pelvic floor exercises in the rehabilitation of weakened pelvic muscles. It can be very beneficial for both men and women who are unable to contract these muscles on command as it may teach the correct action. These electrical currents stimulate and contract the same muscles as Kegel exercises.

PFES of the pudendal nerve (the nerve that innervates the pelvic floor muscle) at a relatively high frequency can cause a pelvic floor muscle contraction through a pudendal nerve reflex loop. The majority of the nerve fibers that supply the muscle of the bladder and pelvic operate at relatively high frequencies of 50 – 100 HZ. PFES causes:

1. A direct motor response to the muscle (limited)
2. A reflex widespread contraction of pelvic floor musculature.

PFES improves the function of the bladder and levator ani (pelvic floor) muscle groups. These include the smooth muscle and striated muscle types.

PFES is used as an adjunct to pelvic muscle exercises and with biofeedback therapy to:

- Assist with identification and isolation of pelvic muscle
- Increase pelvic muscle contraction strength
- Decrease unwanted or uninhibited detrusor (bladder) muscle contraction
- Assist with normalizing pelvic muscle relaxation

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The key components of PFES are as follows:

1. Amplitude. Amplitude is the intensity of the electrical current. The amplitude must be sufficient to cause the anus to contract reflexively, or create an "anal wink." **The electrical current reaching the muscle is non-therapeutic if it does not produce an anal wink.**
2. Ramping. Ramping is the ability of the electrical current to reach the muscle either quickly or slowly. The more gradual the current rises to the pre-set amplitude or threshold level, the more comfortable the stimulation may feel to the person. Likewise, the more aggressive the ramp, or the more vertical the ramping up signal, the more likely a person may experience discomfort.
3. Frequency Rate. The rate or frequency refers to the number of pulses that are generated per unit of time (seconds). This is reported as HZ (hertz). The optimal frequency of electrical stimulation is determined by how quickly the impulses pass through the nerve being targeting (conduction velocity). The frequency rate is contingent on the diagnosis:

- Stress urinary incontinence = 50 HZ
- Urge urinary incontinence = 12 HZ.

High frequency (50HZ) builds strength (bulks up muscle, increases urethral closure.) Low frequency (12 HZ) has a calming effect on the detrusor muscle thus decreasing unwanted bladder contractions. Even when a person has urge UI it may be best to start with the stress mode to increase strength, which enhances urge inhibition and bladder retraining.

4. On/off time. On time is the amount of time that the electrical current is exposed to the muscle. Off time is the amount of time when there is no electrical current to the muscle, allowing it to recover. The ability to allow the muscle to recover is determined by the professional administering the PFES using the following guidelines:

- At no time should the exposure to the electrical current be more than a one-to-one ratio – **which is time-off should never be less than time on.**
- In many cases, a one-to-two ratio, one being on and two being off, will be the most appropriate. **Example: 5 seconds on, 10 seconds off.** This is especially true in the beginning stages of therapy when a person has very weak muscle strength.
- An adjustment to a one-to-two ratio (i.e. 5 seconds on/ 10 seconds off) or a one to one and one/half ratio (i.e. 1:1.5) to allow the patient a greater recovery time and to increase their resistance to fatigue.

PFES is applied to the body by using skin electrodes around the anus or by vaginal or rectal sensors (probes) and may be used in conjunction with biofeedback. The electrical stimulation heightens perception of the pelvic muscle activity and biofeedback reinforces a person's efforts to control the bladder.

It is postulated that PFES:

1. Increases the proportion of fast twitch fibers of the pelvic floor muscle
2. Increases the number and strength of slow twitch fibers of the pelvic floor muscle thus improving resting urethral closure.
3. Improves recruitment of pelvic muscle fibers when doing voluntary pelvic muscle contractions.
4. Can relax and inhibit bladder activity or bladder contractions that cause urinary urgency, frequency and urge incontinence

Persons with the following medical conditions may benefit from the use of PFES:

- Stress and urge urinary incontinence
- Urinary retention
- Sensory urgency syndrome of the bladder
- Dysuria
- Dyspareunia (painful sexual intercourse)
- [Interstitial cystitis](#)
- Dysmenorrhea

A physician, nurse, nurse practitioner, physical therapist who is experienced in the treatment of person's with these medical conditions can perform electrical stimulation. Electrical stimulation is usually combined with a pelvic muscle exercise program.

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There are contraindications for PFES and persons with the following conditions should not use electrical stimulation

1. Complete denervation of the pelvic floor (will not respond)
2. Dementia
3. Demand cardiac (heart) pacemaker
4. Unstable or serious cardiac arrhythmia
5. Pregnancy or planning/attempting pregnancy
6. Broken/irritated peri-anal skin
7. Rectal bleeding
8. Active infection (UTI/vaginal)
9. Unstable seizure disorder
10. Swollen, painful hemorrhoids

The 1996 Agency for Health Care Policy and Research (AHCPR) treatment guidelines for urinary incontinence indicated that functional electrical stimulation (PFES) acts by contracting levator ani, external urethral and anal sphincters, and causes a reflex inhibition of the detrusor. It may be helpful in women with mixed urge and stress incontinence.

Urinary Incontinence in Women

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Urinary incontinence is an inability to hold your urine until you get to a toilet. More than 13 million people in the United States--male and female, young and old--experience incontinence. It is often temporary, and it always results from an underlying medical condition.

(In this fact sheet, the term "incontinence" will be used to mean urinary incontinence.)

Women experience incontinence twice as often as men. Pregnancy and childbirth, menopause, and the structure of the female urinary tract account for this difference. But both women and men can become incontinent from neurologic injury, birth defects, strokes, multiple sclerosis, and physical problems associated with aging.

Older women, more often than younger women, experience incontinence. But incontinence is not inevitable with age. Incontinence is treatable and often curable at all ages. If you experience incontinence, you may feel embarrassed. It may help you to remember that loss of bladder control can be treated. You will need to overcome your embarrassment and see a doctor to learn if you need treatment for an underlying medical condition.

Incontinence in women usually occurs because of problems with muscles that help to hold or release urine. The body stores urine--water and wastes removed by the kidneys--in the bladder, a balloon-like organ. The bladder connects to the urethra, the tube through which urine leaves the body.

During urination, muscles in the wall of the bladder contract, forcing urine out of the bladder and into the urethra. At the same time, sphincter muscles surrounding the urethra relax, letting urine pass out of the body (see figure 1). Incontinence will occur if your bladder muscles suddenly contract or muscles surrounding the urethra suddenly relax.

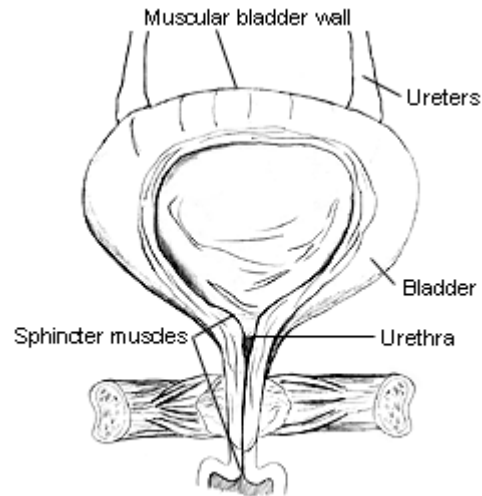


Figure 1.--Front view of bladder and sphincter muscles

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What are the types of incontinence?

Stress Incontinence

If coughing, laughing, sneezing, or other movements that put pressure on the bladder cause you to leak urine, you may have stress incontinence. Physical changes resulting from pregnancy, childbirth, and menopause often cause stress incontinence. It is the most common form of incontinence in women and is treatable.

Pelvic floor muscles support your bladder (see figure 2). If these muscles weaken, your bladder can move downward, pushing slightly out of the bottom of the pelvis toward the vagina. This prevents muscles that ordinarily force the urethra shut from squeezing as tightly as they should. As a result, urine can leak into the urethra during moments of physical stress. Stress incontinence also occurs if the muscles that do the squeezing weaken.

Stress incontinence can worsen during the week before your menstrual period. At that time, lowered estrogen levels might lead to lower muscular pressure around the urethra, increasing chances of leakage. The incidence of stress incontinence increases following menopause.

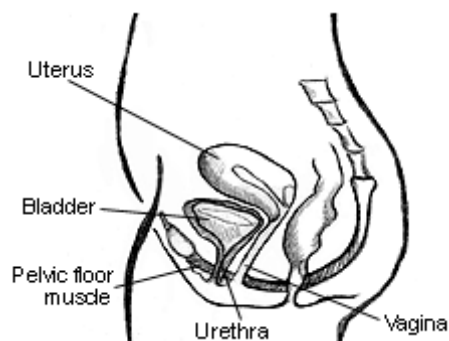


Figure 2.--Side view of female pelvic muscles

Urge Incontinence

If you lose urine for no apparent reason while suddenly feeling the need or urge to urinate, you may have urge incontinence. The most common cause of urge incontinence is inappropriate bladder contractions.

Medical professionals describe such a bladder as "unstable," "spastic," or "overactive." Your doctor might call your condition "reflex incontinence" if it results from overactive nerves controlling the bladder.

Urge incontinence can mean that your bladder empties during sleep, after drinking a small amount of water, or when you touch water or hear it running (as when washing dishes or hearing someone else taking a shower).

Involuntary actions of bladder muscles can occur because of damage to the nerves of the bladder, to the nervous system (spinal cord and brain), or to the muscles themselves. Multiple sclerosis, Parkinson's disease, Alzheimer's disease, stroke, and injury--including injury that occurs during surgery--all can harm bladder nerves or muscles.

Functional Incontinence

People with functional incontinence may have problems thinking, moving, or communicating that prevent them from reaching a toilet. A person with Alzheimer's disease, for example, may not think well enough to plan a timely trip to a restroom. A person in a wheelchair may be blocked from getting to a toilet in time. Conditions such as these are often associated with age and account for some of the incontinence of elderly women in nursing homes.

Overflow Incontinence

If your bladder is always full so that it frequently leaks urine, you have overflow incontinence. Weak bladder muscles or a blocked urethra can cause this type of incontinence. Nerve damage from diabetes or other diseases can lead to weak bladder muscles; tumors and urinary stones can block the urethra. Overflow incontinence is rare in women.

Other Types of Incontinence

Stress and urge incontinence often occur together in women. Combinations of incontinence--and this combination in particular--are sometimes referred to as "mixed incontinence."

"Transient incontinence" is a temporary version of incontinence. It can be triggered by medications, urinary tract infections, mental impairment, restricted mobility, and stool impaction (severe constipation), which can push against the urinary tract and obstruct outflow.

The Types of Urinary Incontinence

Stress	Leakage of small amounts of urine during physical movement (coughing, sneezing, exercising).
Urge	Leakage of large amounts of urine at unexpected times, including during sleep.
Functional	Untimely urination because of physical disability, external obstacles, or problems in thinking or communicating that prevent a person from reaching a toilet.
Overflow	Unexpected leakage of small amounts of urine because of a full bladder.
Mixed	Usually the occurrence of stress and urge incontinence together.
Transient	Leakage that occurs temporarily because of a condition that will pass (infection, medication).

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How is incontinence evaluated?

The first step toward relief is to see a doctor who is well acquainted with incontinence to learn the type you have. A urologist specializes in the urinary tract, and some urologists further specialize in the female urinary tract. Gynecologists and obstetricians specialize in the female reproductive tract and childbirth. A urogynecologist focuses on urological problems in women. Family practitioners and internists see patients for all kinds of complaints. Any of these doctors may be able to help you.

To diagnose the problem, your doctor will first ask about symptoms and medical history. Your pattern of voiding and urine leakage may suggest the type of incontinence. Other obvious factors that can help define the problem include straining and discomfort, use of drugs, recent surgery, and illness. If your medical history does not define the problem, it will at least suggest which tests are needed.

Your doctor will physically examine you for signs of medical conditions causing incontinence, such as tumors that block the urinary tract, stool impaction, and poor reflexes or sensations, which may be evidence of a nerve-related cause.

Your doctor will measure your bladder capacity and residual urine for evidence of poorly functioning bladder muscles. To do this, you will drink plenty of fluids and urinate into a measuring pan, after which the doctor will measure any urine remaining in the bladder. Your doctor may also recommend

- **Stress test**--You relax, then cough vigorously as the doctor watches for loss of urine.
- **Urinalysis**--Urine is tested for evidence of infection, urinary stones, or other contributing causes.

- Blood tests--Blood is taken, sent to a laboratory, and examined for substances related to causes of incontinence.
- Ultrasound--Sound waves are used to "see" the kidneys, ureters, bladder, and urethra.
- Cystoscopy--A thin tube with a tiny camera is inserted in the urethra and used to see the inside of the urethra and bladder.
- Urodynamics--Various techniques measure pressure in the bladder and the flow of urine.

Your doctor may ask you to keep a diary for a day or more, up to a week, to record when you void. This diary should note the times you urinate and the amounts of urine you produce. To measure your urine, you can use a special pan that fits over the toilet rim.

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How is incontinence treated?

Exercises

Kegel exercises to strengthen or retrain pelvic floor muscles and sphincter muscles can reduce or cure stress leakage. Women of all ages can learn and practice these exercises, which are taught by a health care professional.

Most Kegel exercises do not require equipment. However, one technique involves the use of weighted cones. For this exercise, you stand and hold a cone-shaped object within your vagina. You then substitute cones of increasing weight to strengthen the muscles that help keep the urethra closed.

Electrical Stimulation

Brief doses of electrical stimulation can strengthen muscles in the lower pelvis in a way similar to exercising the muscles. Electrodes are temporarily placed in the vagina or rectum to stimulate nearby muscles. This will stabilize overactive muscles and stimulate contraction of urethral muscles. Electrical stimulation can be used to reduce both stress incontinence and urge incontinence.

Biofeedback

Biofeedback uses measuring devices to help you become aware of your body's functioning. By using electronic devices or diaries to track when your bladder and urethral muscles contract, you can gain control over these muscles. Biofeedback can be used with pelvic muscle exercises and electrical stimulation to relieve stress and urge incontinence.

Timed Voiding or Bladder Training

Timed voiding (urinating) and bladder training are techniques that use biofeedback. In timed voiding, you fill in a chart of voiding and leaking. From the patterns that appear in your chart, you

can plan to empty your bladder before you would otherwise leak. Biofeedback and muscle conditioning--known as bladder training--can alter the bladder's schedule for storing and emptying urine. These techniques are effective for urge and overflow incontinence.

Medications

Medications can reduce many types of leakage. Some drugs inhibit contractions of an overactive bladder. Others relax muscles, leading to more complete bladder emptying during urination. Some drugs tighten muscles at the bladder neck and urethra, preventing leakage. And some, especially hormones such as estrogen, are believed to cause muscles involved in urination to function normally.

Some of these medications can produce harmful side effects if used for long periods. In particular, estrogen therapy has been associated with an increased risk for cancers of the breast and endometrium (lining of the uterus). Talk to your doctor about the risks and benefits of long-term use of medications.

Pessaries

A pessary is a stiff ring that is inserted by a doctor or nurse into the vagina, where it presses against the wall of the vagina and the nearby urethra. The pressure helps reposition the urethra, leading to less stress leakage. If you use a pessary, you should watch for possible vaginal and urinary tract infections and see your doctor regularly.

Implants

Implants are substances injected into tissues around the urethra. The implant adds bulk and helps to close the urethra to reduce stress incontinence. Collagen (a fibrous natural tissue from cows) and fat from the patient's body have been used. Implants can be injected by a doctor in about half an hour using local anesthesia.

Implants have a partial success rate. Injections must be repeated after a time because the body slowly eliminates the substances. Before you receive collagen, a doctor must perform a skin test to determine whether you would have an allergic reaction to the material.

Surgery

Doctors usually suggest surgery to alleviate incontinence only after other treatments have been tried. Many surgical options have high rates of success.

Most stress incontinence results from the bladder dropping down toward the vagina. Therefore, common surgery for stress incontinence involves pulling the bladder up to a more normal position. Working through an incision in the vagina or abdomen, the surgeon raises the bladder and secures it with a string attached to muscle, ligament, or bone.

For severe cases of stress incontinence, the surgeon may secure the bladder with a wide sling. This not only holds up the bladder but also compresses the bottom of the bladder and the top of the urethra, further preventing leakage.

In rare cases, a surgeon implants an artificial sphincter, a doughnut-shaped sac that circles the urethra. A fluid fills and expands the sac, which squeezes the urethra closed. By pressing a valve

implanted under the skin, you can cause the artificial sphincter to deflate. This removes pressure from the urethra, allowing urine from the bladder to pass.

Catheterization

If you are incontinent because your bladder never empties completely (overflow incontinence) or your bladder cannot empty because of poor muscle tone, past surgery, or spinal cord injury, you might use a catheter to empty your bladder. A catheter is a tube that you can learn to insert through the urethra into the bladder to drain urine. Catheters may be used once in a while or on a constant basis, in which case the tube connects to a bag that you can attach to your leg. If you use a long-term (or indwelling) catheter, you should watch for possible urinary tract infections.

Other Procedures

Many women manage urinary incontinence with pads that catch slight leakage during activities such as exercising. Also, you often can reduce incontinence by restricting certain liquids, such as coffee, tea, and alcohol.

Finally, many women who could be treated resort instead to wearing absorbent undergarments, or diapers--especially elderly women in nursing homes. This is unfortunate, because diapering can lead to diminished self-esteem, as well as skin irritation and sores. If you are an elderly woman, you and your family should discuss with your doctor the possible effectiveness of treatments such as timed voiding, pelvic muscle exercises, and electrical stimulation before resorting to absorbent pads or undergarments.

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Points to Remember

- Urinary incontinence is common in women.
- All types of urinary incontinence can be treated.
- Incontinence can be treated at all ages.
- You need not be embarrassed by incontinence.