

Osso Bock[®]

QUALITY FOR LIFE



Osteoporosis Causes and Therapy

Table of Contents

Osteoporosis	3
The most common metabolic bone disease	3
Causes of Osteoporosis	4
Bone structure	4
Bone metabolism	5
Bone mass development	5
Typical Consequences of Osteoporosis	6
Displacement of the body's center of gravity	6
Deterioration of quality of life	6
Lung impairment	6
Symptoms of Osteoporosis	7
Osteoporotic fractures	7
Osteoporosis – Risk Factors and Prevention	8
Risk factors	8
Early prevention – with a bone-friendly diet	9
Early prevention – exercise gives you strong bones	9
Diagnosis and Therapy of Osteoporosis	10
Early diagnosis	10
Successful therapy	10
Medication	11
Therapy with orthopedic appliances	11
Dorso Osteo Care	12
When to use the Dorso Osteo Care	13
Hyperextension Orthoses	14
When to use Hyperextension Orthoses	15

Osteoporosis

The most common metabolic bone disease

Osteoporosis, which is also known as degeneration of the bone, has a slow, insidious effect. For this reason, many people affected by the disease often do not even know it. The risk to get osteoporosis is high, however. Statistically, every second woman and every fifth man have a bone fracture caused by osteoporosis once in their lifetime.

The bone mass decreases and the bone structure deteriorates, and as a result the density of the bone and thus its load capacity decrease. In the advanced stages of the disease even minor loading or low impact falls can cause fractures.

Early diagnosis and treatment of osteoporosis are essential for therapeutic success. Prevention is also especially important, and during the early stages of osteoporosis it is important to take steps against the progress of the disease.

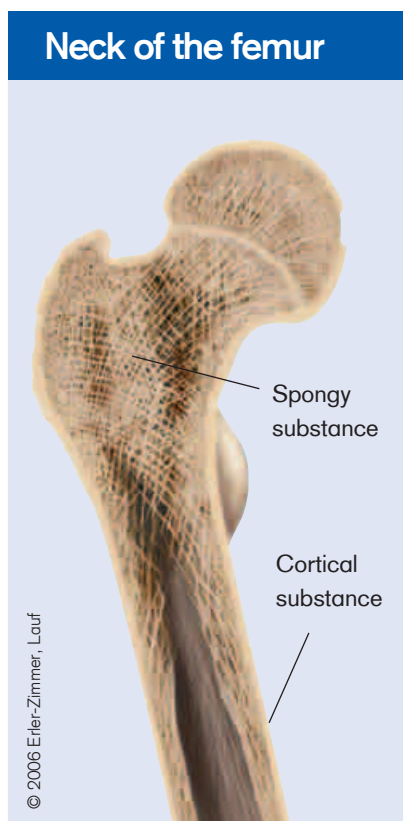
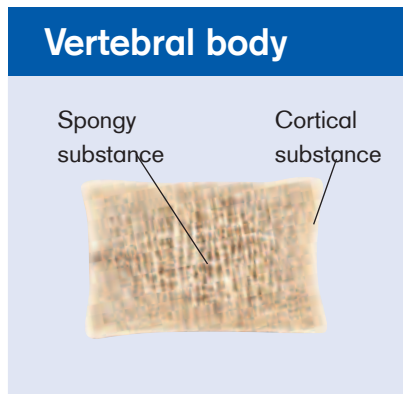


Did you know?

- The World Health Organization (WHO) lists osteoporosis as one of the world's ten most important and most expensive diseases.
- In Germany, about 4 million people (i.e. every third woman and every fifth man older than 50 years) suffer from manifest osteoporosis.

Causes of Osteoporosis

Bone structure



Our bones consist of two structural components, designed to handle the various demands placed on them regarding strength and elasticity.

The outer layer of the bone, called the cortical substance, is a very dense bony tissue giving the bone its strength. Inside there is the spongy substance. This fine network of trabecular structures gives the bone its elasticity.

Especially in the axial skeleton, e. g. in the vertebral bodies, in the neck of the femur, in the ribs and in the heel, the fine lattice structure of the spongy substance prevails. The denser the trabeculae are, the more stable the bone is. Because of their structure, the mainly trabecular bones are able to bear bending forces and to distribute them over the entire bones.

The long tubular bones of the extremities contain a particularly large amount of the cortical bone, since they mainly have to bear compressive forces during movement. The ratio of spongy and cortical parts varies from bone to bone.

Osteoporosis concerns above all the mainly trabecular bones, since they undergo a much faster and more extensive bone transformation than the cortical bones. The struts of the spongy substance increasingly become thinner and more porous, and finally decomposed completely. The defective architecture results in loss of elasticity and stability, and the bone runs the risk of breaking, even under minor loads. The loss of bone mass of cortical bones progresses slower so that their risk of breaking is present only at an advanced stage of osteoporosis.

Bone mass reduction in a woman's and a man's course of life		
	Woman	Man
Trabecular part of the bone	35 – 50 %	15 – 45 %
Cortical part of the bone	25 – 30 %	5 – 15 %

Bone mass development

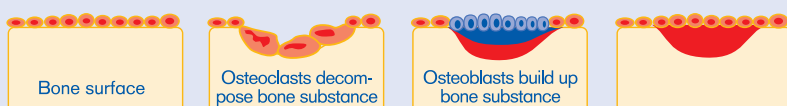
The skeleton is steadily built up from birth, through puberty and on into early adulthood. Up until about the age of 30, bone formation prevails. Then, bone disintegration prevails: Every year, a bone mass reduction of about 1 % takes place. In other words, a 70 years old man has already lost about 40 % of his bone mass. Women are affected by osteoporosis four times as often as men. After menopause their production of estrogen, a hormone which inhibits the osteoclasts in their function as “bone eaters”, decreases. If this inhibiting effect is missing, the process of bone disintegration and bone formation becomes unbalanced. For this reason, women after menopause lose as much as 4 % of their bone mass every year.

So-called geriatric osteoporosis affects about 50 % of all people older than 70 years.

Process of bone mass regeneration

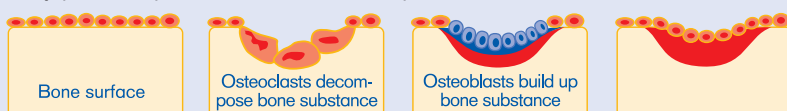
Healthy bone metabolism

Complete replacement of the decomposed bone



Osteoporosis

Only partial replacement of the decomposed bone

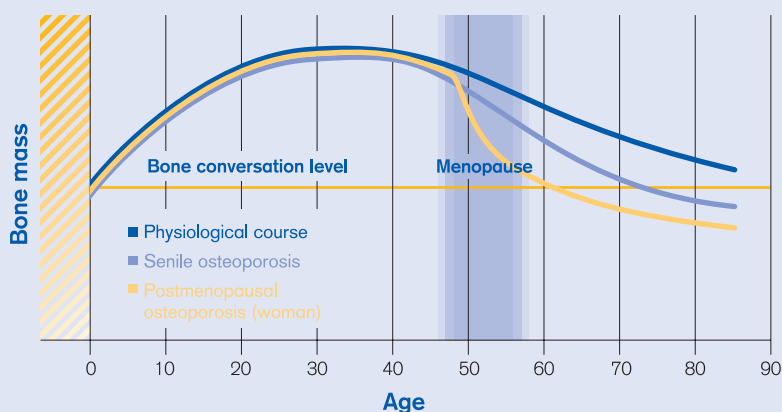


Bone metabolism

Human bones as living tissue undergo a permanent process of transformation. The bone is continually renewed: Aging, damaged bone mass is decomposed and replaced by new mass. Furthermore, the bones are always adapted to the existing muscle mass and to the body load situation. The main players in this process are osteoclasts and osteoblasts. Different hormones (e.g.

estrogen, testosterone, parathormone, and calcitonin) as well as physical exercise control the activity of these two cell systems. The osteoclasts (bone decomposing cells) are responsible for bone mass destruction. Afterwards, the osteoblasts (bone building cells) build up new bone mass.

Normal and osteoporotic bone mass development



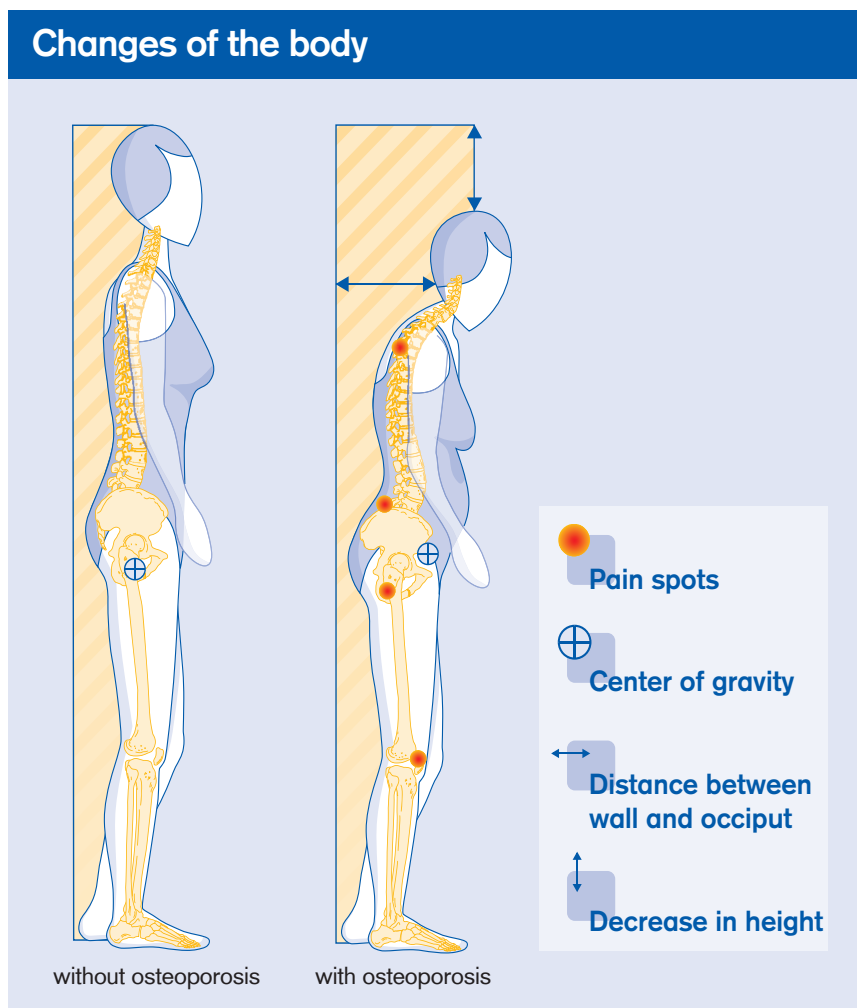
Human bone mass grows until approximately the 30th year of life. At this age, the bones have reached the maximal mass of bone substance and mineral content. The extent of maximal bone mass formation, which varies from individual to individual, mainly depends on the nutrition and exercise.

Typical Consequences of Osteoporosis

Displacement of the body's center of gravity

As osteoporosis progresses, the load bearing capacity of the vertebral bodies decreases, and first the upper plates break. A growing number of vertebral body fractures lead to an increased curvature of the spinal column. In the thoracic spine, partial vertebral fractures result in increasing kyphosis ("widow's hump"), and in the lumbar spine they result in increased lordosis. In addition, the abdomen can extend forward, creating a "pot belly". Due to the compression of the vertebral bodies, the body height decreases by up to 20 cm or even more within a few years. The shifting of the body's center of gravity to the front increases the risk of falls and thus also the risk of other fractures.

Back pain that comes along with progressing osteoporosis is often due to tensed and shortened muscles caused by the static changes of the body.



Deterioration of quality of life

Chronic pain, shortness of breath and poor mobility considerably diminish the quality of life. The resulting vicious circle of fear of falls and fractures, immobilization, lack of independence and isolation must be broken, since the increasing lack of exercise, besides the restriction of the quality of life, also accelerates bone destruction.

Lung impairment

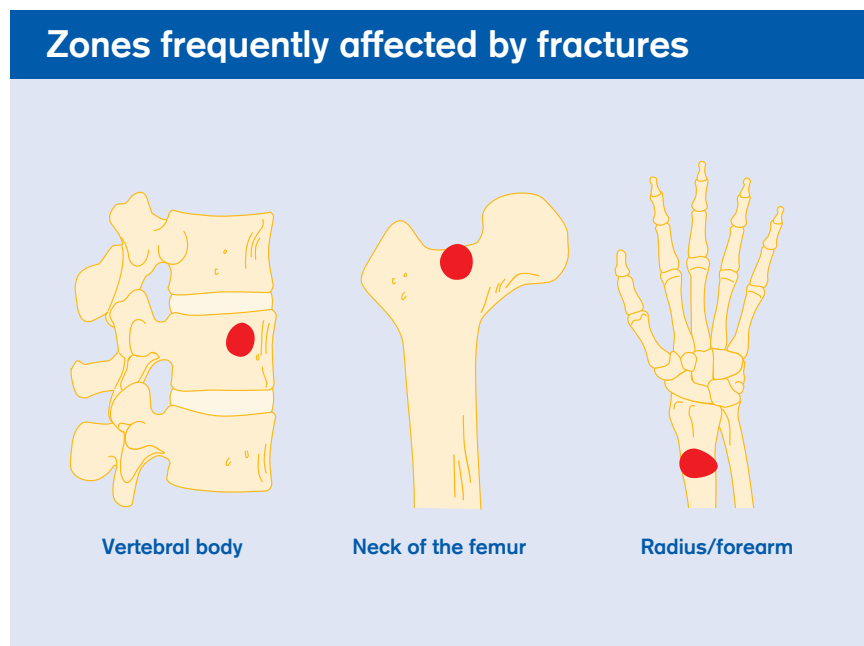
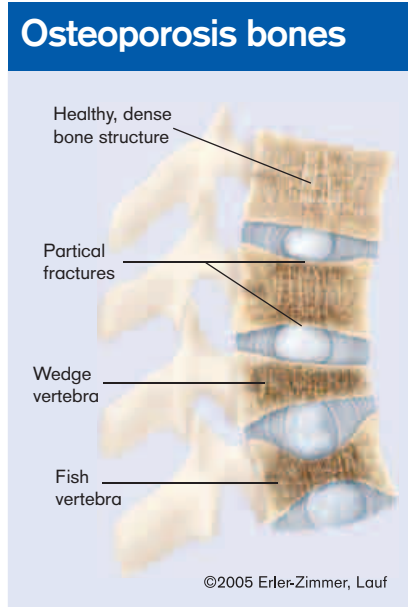
The changing shape of the spinal column and the decrease of body height can result in impaired breathing because the chest cavity has less space for expansion.

Symptoms of Osteoporosis

Osteoporotic fractures

Osteoporosis is a disease with an insidious course, because those afflicted may not feel the effects for a long time. The pain they feel is often assumed to be caused by their advanced age. In most cases, forearm fractures are the first signs that might let one think of osteoporosis. The first partial vertebral fractures can remain unnoticed, too; or the patient suddenly feels strong pain.

Decreasing bone mass leads to increased bone brittleness. As a result, normally harmless falls or even lifting objects can lead to fractures. Zones which are frequently affected by fractures are the forearm, the spinal column and the section of the femur that is close to the hip.



Did you know?

Incidence of osteoporotic fractures in Germany

- Approx. 500,000 per year, thereof:
- **Vertebral body fractures** approx. 225,000 per year – healing process takes about 2 to 4 months
- **Fractures of neck of femur** approx. 100,000 per year – healing process takes about 4 to 8 months
- **Radial fractures** approx. 80,000 per year – healing process takes about 6 to 8 weeks
- **Other fractures** approx. 95,000 per year

Osteoporosis – Risk Factors and Prevention

Risk factors



There are many factors promoting the development of osteoporosis, although they do not necessarily bring it about. Besides a congenital predisposition for getting affected by osteoporosis, there are a number of other risk factors that cannot be influenced. It is important, however,

to know the factors which have a direct effect on the bones' health and which can be influenced.

Nutritional Thieves

In case of excessive consumption, the following ingredients have a negative effect on the bones' health:

- alcohol
- caffeine (e. g. coffee, tea)
- sugar (e. g. soda)
- salt
- egg white
- phosphate (e.g. meat, sausages)
- fats

Risk factors that can be controlled

■ A diet low in calcium

Calcium is the most important constituent of bones. The calcium stored in our bones is also required for a number of body functions such as the beating of the heart. If a person's nutrition contains an insufficient amount of calcium, their body will fall back upon the calcium which is stored in the bones.

■ Alcohol and nicotine

The consumption of alcohol not only results in increased excretion of calcium, but also keeps the organism from absorbing a sufficient amount of calcium.

Nicotine as well can have a negative influence on the bone metabolism. In women, smoking leads to a decreased formation of estrogen; at the same time, more estrogen is decomposed in the liver.

■ Lack of exercise

The organism always tries to create an optimal balance of muscle mass and bone mass. A lack of exercise leads to muscle reduction and thus to bone mass reduction.

Risk factors that cannot be controlled

■ Inheritance

Chances of having osteoporosis are much higher if one's mother or grandmother has suffered from it.

■ Underweight

People with a low body weight maintain less bone mass and thus have an increased risk of getting osteoporosis.

■ Old age

At an older age, bone destruction overtakes bone formation. The risk of fractures grows increasingly with age.

■ Gender and early menopause

For women, the risk of being affected by osteoporosis is four times higher than for men. After menopause, estrogen, which has a bone protecting effect, is no longer produced, thus increasing the need for calcium. Because of the missing production of estrogen, early onset of menopause has a further, negative effect on the bones.

Early prevention – with a bone-friendly diet

Calcium is the most important mineral for the bones and must be taken in via food. To be able to build up the maximal bone mass at all, a sufficient intake of calcium is indispensable. That is why children and adolescents during the phase of bone formation need up to four times as much calcium as adults. Many people take in considerably less calcium than is needed for the formation and preservation of their bones. Women should increase their daily amount of calcium, especially during pregnancy and lactation as well as after the menopause. Foods that contain much calcium are for example low-fat milk and hard cheese, fresh vegetables and fruits as well as fruit juices and mineral water.

A bone-friendly diet also includes sufficient intake of vitamins. Vitamin D plays an especially important role for bone formation, because it is needed to enable the body to absorb calcium and phosphate from the intestines. Within the body, vitamin D is produced only while we are exposed to the sun, so it's important to get outdoors on a daily basis. Since today's living conditions often do not ensure a sufficient production of vitamin D, it may be necessary to take additional amounts through your diet. Furthermore, the vitamins C and A, among others, have a positive effect on bone formation.



Early prevention – exercise gives you strong bones

Muscle training is of great importance for preserving bone mass, because there is a close connection between muscle mass and bone mass. That is why exercise strengthens not only the muscles but also the bones. Both regulation systems optimally match each other, which means that a loss of muscle mass also results in a loss of bone mass. Because the minerals which are important for bone formation will be incorporated in the bone only if tensile forces caused by movement act on the bones, muscles and tendons. Sports which are especially good for the bones are those acting against the force of gravity: e.g. basketball, handball, jogging, and squash.

Regular exercise helps to maintain quality of life for everyone, but especially for those who have already been diagnosed with osteoporosis. This is because strong muscles and bones reduce the risk of falling and keep people more mobile, allowing them to care for themselves for a long time. For this reason, sports and physical therapy have their firm place in the treatment of osteoporosis. Regular walks, Nordic walking and even short bicycle rides have a positive effect on bone metabolism. Special osteoporosis gymnastics are also advisable.

Did you know?

Costs for the treatment of osteoporosis in Germany

- More than 10 billion € per year, thereof:
- Approx. 70 % for the treatment of fractures, for example,
- approx. 7 % for medication.

Diagnosis and Therapy of Osteoporosis

Staging of osteoporosis on the basis of the T-value*

■ Stage of prevention

T-value < -1 SD**

Normal findings

T-value between -1 SD and -2.5 SD

Osteopenia

■ Stages of therapy

T-value < -2.5 SD

Preclinical osteoporosis (without fractures)

T-value < -2.5 SD

Manifest osteoporosis (with fractures)

* **T-value:** comparison of the patient with a reference population between 20 and 40 years

** **SD:** standard deviation

Therapy goals

- **Stop the osteoporosis at an early stage**
- **Alleviate pain**
- **Mobilize the patient**
- **Strengthening the muscles**
- **Prevent fractures**

Early diagnosis

As with many diseases, early identification of osteoporosis is important in order to minimize its effects. There are various methods for diagnosing osteoporosis.

One of the most reliable methods for identifying osteoporosis is to measure the bone density (e.g. DXA method). For determining the type of therapy required, the degree

of severity of the osteoporosis must be assessed first. According to WHO guidelines, the so-called T-value as criterion for the diagnosis indicates to what extent the bone density deviates from the statistical mean value. For measuring the T-value the DXA method is used.

Successful therapy

No one affected by osteoporosis has to resign himself or herself with the disease. Today, there are excellent methods for treating osteoporosis, and with an early diagnosis it can even be healed!

The treatment of osteoporosis is an interdisciplinary therapy and is made up of a number of components, because only a combined application of drugs and appliances as well as of kinesitherapy and gymnastics provide optimal treatment and care of the patient. Active cooperation by the patient is decisive for the success of the therapy.

Possibilities of therapy



Medication

- Analgesic drugs
- Drugs that promote bone formation



Therapy with orthopedic appliances

- Pain relief
- Stabilization of the spinal column
- Mobilization after a fracture
- Activation and formation of muscles
- Reduction of fracture risk



Physical therapy and exercise

- Reduction of muscle tension
- Pain relief
- Formation of muscles, strengthening of the bones (refer to page 9)

Medication

Calcium with vitamin D is indicated as basic medication. The treating physician will determine from which point in time other drugs for stopping bone destruction and promoting bone mass formation are indicated.

After occurrence of an osteoporotic fracture, additional bisphosphonates have been used successfully for years. Bisphosphonates inhibit the osteoclasts and not only stop bone destruction (refer to page 5), but also cause the bone density to increase. The increase of density is equal for spongy and cortical bones.

Other agents used to inhibit bone destruction are the so-called SERMs (selective estrogen receptor modulators), calcitonin and parathormone. The SERMs are hormone-like preparations which act like female estrogen and thereby stimulate bone formation without, however, causing the side effects estrogen causes. Calcitonin has two effects: it inhibits bone disintegration and relieves pain. For this reason, it is mainly used after fractures. Parathormone stimulates the osteoblasts for the formation of new bone mass.



Therapy with orthopedic appliances

When feeling pain and in fear of fractures, the patient takes a relieving but incorrect posture and becomes more and more inactive. The therapy with orthopedic appliances aims at maintaining the patient's mobility for a long time or to restore it after fractures. Because only with sufficient activity, bone mass decrease can be prevented and muscle formation be achieved.

As first therapeutic measure, the so-called "pain spiral" must be broken. Depending on their design, orthoses are capable of alleviating pain, correcting the body posture, or restricting movements that would overload the skeleton, and are thus also capable of preventing fractures.

A growing number of vertebral body fractures lead to an increased curvature of the spinal column. Static changes of the body that accompany this deformation put heavier strain on muscles and ligaments than usual, and acute back pain can change into chronic

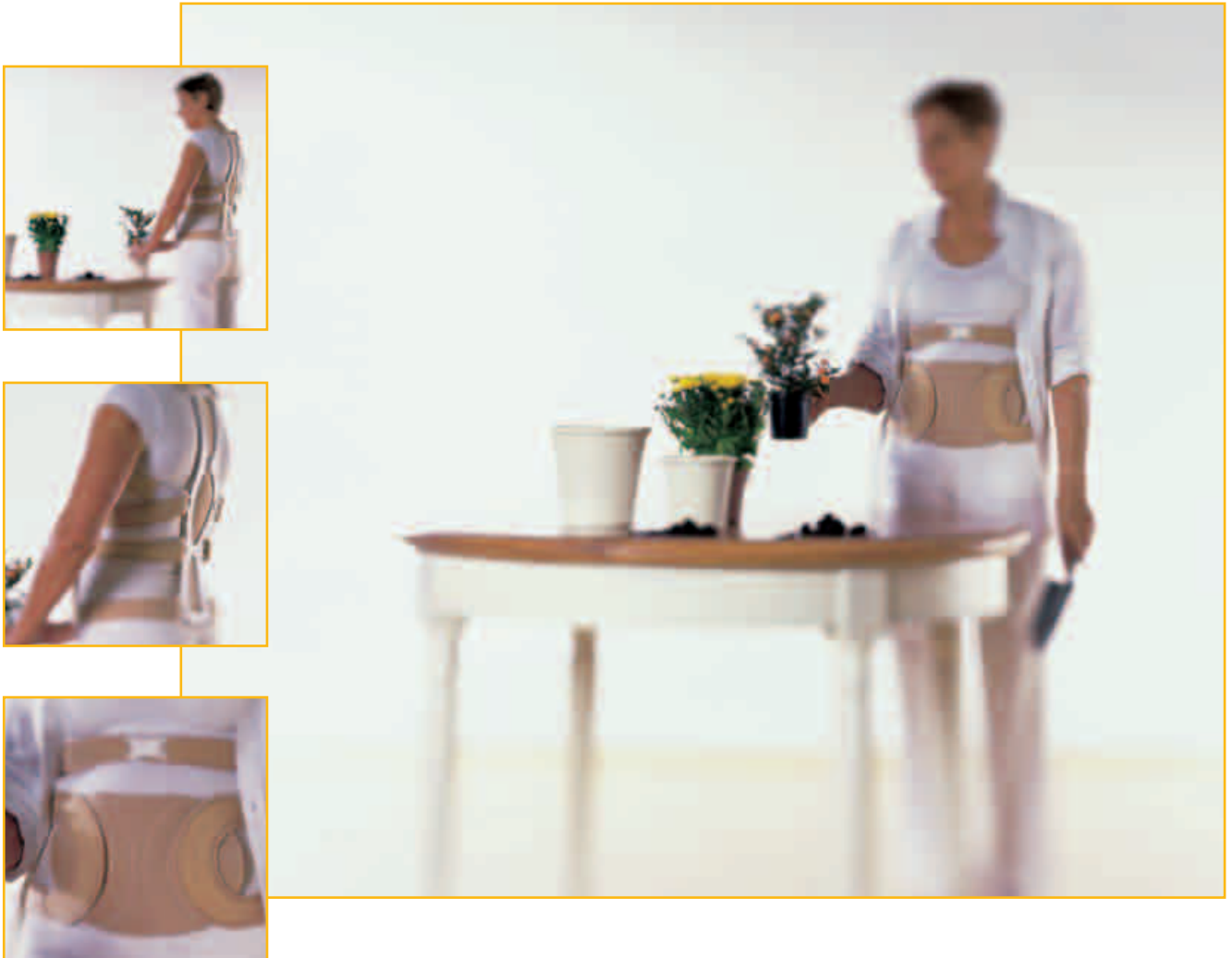
pain. To prevent a relieving but incorrect posture as well as increasing inactivity, it is essential to remobilize the patient as soon as possible. Orthoses with straightening effect such as the Dorso Osteo Care shift the body's center of gravity backwards again, resulting in increased security for the patient while standing and moving. This feeling of security enables the patient to move more again. Muscles are stimulated and strengthened. With each movement, the muscles act upon the bones with tensile forces thus promoting bone formation.

Acute pain, often caused by a fracture in the spinal column, can be relieved by using hyperextension orthoses. These orthoses straighten, stabilize and relieve the spine. At the same time, painful movements are restricted.

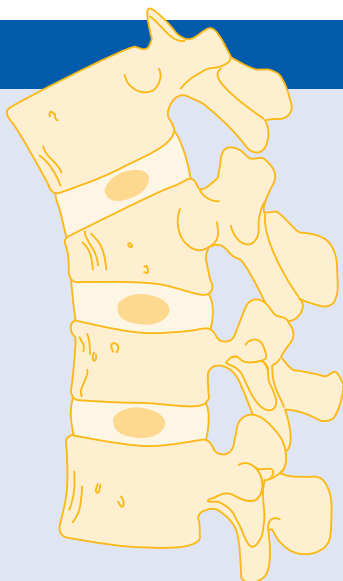
Dorso Osteo Care

Spinal Orthosis for Osteoporosis Patients

50R20



Indications



- Osteoporotic changes in the thoracic and lumbar spine sections
- The Dorso Osteo Care orthosis can be applied during the stages of osteoporosis at which muscle activity can still be used and increased
- For follow-up treatment of osteoporotic vertebral body fractures

When to use Dorso Osteo Care

In cases of osteoporotic changes in the thoracic and lumbar spine sections as well as for follow-up treatment of vertebral body fractures, the Dorso Osteo Care supports patient mobilization and activation.

The orthosis provides active straightening of the upper part of the body. The body's center of gravity is shifted backwards again, and the patient experiences increased security when standing and moving. The upper body is brought into an upright position by retracting the

shoulder girdle and compressing the abdomen. This effect is achieved by adjustable straps and an adaptable back plate. In this way the Dorso Osteo Care helps to activate the back muscles without restricting abdominal and thoracic breathing. The abdominal pad also gently supports the stomach.

The Dorso Osteo Care helps to train the muscles and thus to promote bone formation. The risk of falling and thereby the risk of fractures are efficiently reduced.



Art. no.	Size	Trunk length (cm)
50R20	S	39 – 41.5
	M	42 – 44.5

Effect

- Supports an upright body posture by retracting the shoulder girdle and compressing the abdomen (three-point principle)
- Promotes bone preservation by training the muscles
- Increased security when standing and moving

Benefits

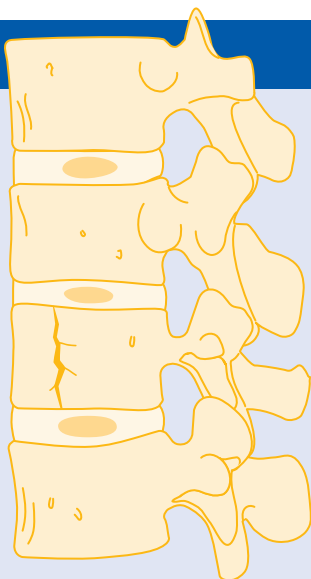
- Reduced risk of falling and thereby reduced risk of fractures
- Thoracic and abdominal breathing unrestricted
- Backpack design makes it easy to don
- Inconspicuous and lightweight design
- All fabrics are breathable, soft and skin-friendly for higher comfort, and washable

Hyperextension Orthoses

28R14 / 28R15 / 28R16



Indications



- Stable compression fractures of the lower thoracic spine and of the lumbar spine without neurological damage

When to use Hyperextension Orthoses

Hyperextension orthoses, which have been proven to be useful in the treatment of stable vertebral body fractures after traumas, can also be applied in case of osteoporotic fractures.

According to the three-point principle, the orthosis straightens the spinal col-

umn. In this way, the orthosis helps to bring the patient into an upright body posture, stabilizes the spine and relieves the ventral parts of the vertebral bodies. Furthermore, flexion movements are prevented and thereby local pain alleviated, which above all occurs at the beginning of mobilization.



Art. no.	Size	Waist circumference (cm)
28R14	S	60 – 75
	M	75 – 90
	L	90 – 105
	XL	105 – 120

Art. no.	Size	Waist circumference (cm)	Trunk width (cm)
28R15	S	60 – 80	31 – 35
	M	75 – 95	33 – 37
	L	90 – 115	36 – 40
	XL	110 – 135	38 – 42

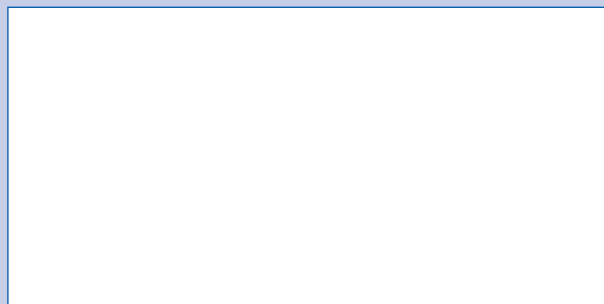
Art. no.	Size	Pelvis circumference (cm)
28R16	S	60 – 75
	M	75 – 90
	L	90 – 105
	XL	105 – 115
	XXL	115 – 125

Effect

- Reclination of the spinal column in the thoracolumbar transition according to the three-point principle
- Efficient relief of the ventral parts of the vertebral bodies helps to alleviate pain

Benefits

- User-friendly, easy-to-use closure
- Low weight
- Skin-friendly materials
- Water-resistant



Please contact us if you have any further questions
or would like to have more information.

Otto Bock[®]

QUALITY FOR LIFE

Otto Bock HealthCare GmbH

Max-Näder-Straße 15 · 37115 Duderstadt/Germany · Phone +49 5527 848-1424 · Fax +49 5527 72330 · healthcare@ottobock.de · www.ottobock.com