



Patient handling for caregivers

2024

epOs

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 English version

All chapters are available free of charge at the website, in different languages: English, Dutch, Spanish, French, Hungarian and Lithuanian

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Foreword

In a society that is becoming more and more diverse and complex, internationalization is a tool, an opportunity to learn how to deal in a better way with that diversity. It's a way to grow towards more experience, towards an open mind and to continue to embed shared values, experiences and European citizenship.

Exchange, sharing knowledge, creating partnerships etc. across borders is an indispensable added value. It facilitates change and progress for the individuals participating, for the organizations that are part of the activities and for the policy systems in which all these activities take place. In short internationalization creates impact on different levels and that's what we want and need. Through the Erasmus+ program numerous possibilities are created to finance projects, creating impact.

eUlift is in my opinion a great example of what internationalization can mean for an organization and all the partners involved. The project based on co-creation shows the possibilities to generate long lasting effects for education and training in general and more specifically for caregivers. eUlift is a strategic partnership financed by Epos, the national agency of Erasmus + in Flanders. The idea for the project had grown for years. Starting from a need in practice the project executors combined best practices and evidence with innovative strategies and sought several partners with a complementary expertise. We must continue to focus strongly on internationalisation. After all, an Erasmus+ project is a means, an opportunity to learn to deal better with diversity and complexity in a society that is constantly changing and to grow towards more experience, an open mind and to continue to focus on the European, horizontal priorities: social inclusion, sustainability, digitalisation and democratic participation.

This project aimed for a long term solution to avoid injuries to caregivers while handling patients. Therefor there are 5 outputs :

1. renewed e-book
2. free of charge app, available in different languages
3. e-learning in safe patient handling
4. e-learning paths to integrate in (continuous) education
5. FAQ's to address some often occurring specialties

Epos wants to be an helpful partner for all projects to make sure that all investments, financially, personal and in terms of content, pay off. We'd be glad to contribute with further dissemination and exploitation of the eUlift project results in order to create and embed impact.

I'm grateful to be a small part of this! Thank you and I wish you all the luck in the future!

Jill, Director Epos

Introduction

Low back pain causes more years lived with disability than any other health condition (Vos et al., 2012). Chronic low back pain is a common, long-lasting, and disabling condition with high societal costs (e.g. healthcare expenditure, disability insurance, and work absenteeism) (Dagenais, Caro & Haldeman, 2008; Lambeek et al., 2011; Luo, Pietrobon, Sun, Liu & Hey, 2004; Maniadakis & Gray, 2000). Healthcare workers are frequently exposed to elevated physical risk factors (e.g. repetitive motions, lifting or lowering), awkward postures and moving or lifting patients. All of these can cause work-related injuries (BLS, 2002, 2006, 2009 & 2010).

Not only nurses experience these problems (Lee & Lee, 2017; Lipscomb, Trinkoff, Brady & Geiger-Brown, 2004). Occupational therapists and physiotherapists are also at higher risk of work-related musculoskeletal injuries (Darragh, Huddleston & King, 2009).

Unfortunately, low back pain in caregivers is not only connected to patient handling techniques (Daynard et al., 2001; Lagerstrom, Hansson & Hagberg, 1998) but as well to static overload (Jansen, Morgenstern & Burdorf 2004).

The ISO/TR 12296:2013 report defines patient handling as:

"...any activity requiring a force to push, pull, lift, lower, transfer or in some way move or support a person or body part."

Patient handling activities can be divided into many small subcategories. One of these is patient lifting, which caregivers often have to perform. Examples of patient handling activities are positioning patients on the bed, transferring them to a wheelchair, assisting them while ambulating, or moving them between different locations (Hignett et al., 2014).

A study regarding lifting at work identified that both the weight of the load (OR 1.11 [95 % CI 1.05–1.18] per 10 kg lifted) and the number of lifts (OR 1.09 [1.03–1.15] per ten lifts per day) increased the risk (Coenen et al., 2014). Although educational and exercising programs intended to avoid back pain in caregivers have proven their effect (Black, Shah, Busch, Metcalfe & Lim, 2011; Daynard et al., 2001; Jaromi et al., 2018), these programs do not offer a long term solution (Theis & Finkelstein, 2014).

Many initiatives are undertaken in practice, from educating and training caregivers to well established patient handling policies, encouraged by an ergocoach, prevention advisor or lifting expert. Still, 31,6% of new healthcare workers report having little to no knowledge of guidelines, regulations, training or a professional framework related to patient handling. This poses a significant risk to safety and strain on both the patient and the caregiver (Karppi et al., 2022).

Safe patient handling programs can make a huge contribution for caregivers, it brings structure and reduces the number of injuries (Teeple, et al., 2017; Thomas & Thomas, 2014; Antwi-Afari et al., 2017). An effective program includes training and feedback and a multidisciplinary team to follow current trends in healthcare (WHO, 2022) and risk analyses to learn and adapt (Ziam et al., 2023).

The European Agency for Safety at Work contributes a considerable amount with *e-fact 28: Patient handling techniques to prevent musculoskeletal disorders (MSD) in health care*, which is available in all European languages. However, a detailed description of how to perform patient handling activities, or how to teach these to caregivers, does not exist.

Therefore, the eUlift project aims for a long-term solution from a self-regulated perspective and integrates an innovative approach, i.e. an app/webapp that can be consulted at every step. We paid particular attention to detailed descriptions of the specific patient handling techniques, postures, and movements.

About the eUlift project

The eUlift project is financed by EPOS, the national agency of Erasmus+.

The objective of this project is to provide support to both formal and informal caregivers in performing daily patient handling. To achieve this, a substantial amount of innovative educational material has been developed, including a comprehensive theoretical and interactive handbook, an online learning pathway, 3D animations, and various educational short films available on YouTube.

This document is the free handbook, ready for download at: www.eulift-app.com. It is available in English, Dutch, French, Hungarian, Spanish and Lithuanian.

We hope you like it



1. General ergonomics

✍ Vandewalle, M., Goderis, T. & Ollevier A.

1.1. Definition of ergonomics

The International Ergonomics Association provides the following definition:

"Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." (IEA, 2018).

Ergonomics has three domains of expertise (IEA, 2018). This handbook focuses on physical ergonomics, specifically work-related musculoskeletal disorders.

1.2. What are musculoskeletal disorders of the back?

Musculoskeletal disorders of the back are injuries and disorders that affect the structures of the back (e.g. muscles, tendons, ligaments, nerves, discs, blood vessels).

These structures can become damaged as a result of the work situation. In addition to back and neck disorders, musculoskeletal disorders can also occur at the upper and lower limbs.

These employee health risks have a significant impact on the company in the form of decreased profits, absenteeism (more than one-third of missed days at work are because of back problems, tendinitis, or neck or shoulder pain), lack of replacement personnel for colleagues who suffer from musculoskeletal disorders, loss of qualified staff and, as a result, of skills. Performing patient handling is associated with work-related disorders among healthcare providers due to repetitive movements, static and physical strain, and the handling of heavy loads (Amaro et al., 2018, Bernal et al., 2015; Fochsen et al., 2006, Knibbe & Knibbe, 2012; Zenker et al., 2020).

The problem does not limit itself to workers carrying out heavy work. Office work can also lead to repetitive strain injuries, inflammations of the tendons in the wrist, and back problems.

1.3. Causal factors of musculoskeletal disorders of the back

Maher, Underwood, and Buchbinder (2017) analyzed data regarding risk factors (for developing low back pain) that were derived from systematic reviews of cohort studies. A review regarding lifting at work identified that both the weight of the load and the number of lifts increased risk. In terms of lifestyle factors, smoking, obesity, and depressive symptoms all increased the risk of developing low back pain. These risk factors increased the odds of back pain by only a modest amount.

Physical factors (e.g., lifting awkwardly), psychosocial factors (e.g., fatigue or tiredness), or a combination of the two (e.g., being distracted while lifting) (Steffens et al., 2015) can all trigger acute low back pain. However, about one third of all patients suffering from an acute episode cannot recall a trigger (Parreira Pdo et al., 2015). New episodes are more likely to begin early in the morning (Steffens et al., 2015). A US study of 1,82 million emergency department presentations for low back

pain revealed that 81 % of episodes began at home, with lifting being the most cited cause.

The most general causes of back pain can be divided into individual, psychosocial, and work-related factors (van Tulder & Koes, 2013).

	Cause	Chronic symptoms
Individual factors	<ul style="list-style-type: none"> • age • physical fitness • strength of the back muscles and abdominal muscles • smoking 	<ul style="list-style-type: none"> • obesity • low education level • a lot of pain, unable to function properly
Psychosocial factors	<ul style="list-style-type: none"> • stress • anxiety • mood/emotions • cognitive functioning • pain behavior 	<ul style="list-style-type: none"> • distress • depression • somatization
Work-related factors	<ul style="list-style-type: none"> • manual material handling • bending and turning • vibrations • dissatisfaction • monotonous tasks • relational or social support • control 	<ul style="list-style-type: none"> • dissatisfaction • impossible to do lighter work when resuming work after sickness • lifting during three-quarters of the day

The most frequently observed prognostic risk factors for chronic low back pain are (Nieminen et al., 2021):

- Higher pain intensity
- Higher body weight
- Carrying heavy loads
- Difficult working positions
- Depression

2. Anatomy and function

Vandewalle, M., Goderis, T. & Ollevier, A.

2.1. Spine

Anatomy

The spine measures two-fifths the length of the human body. A quarter of this length is taken up by the intervertebral discs. The vertebral column consists of 24 presacral vertebrae (seven cervical vertebrae, twelve thoracic vertebrae, five lumbar vertebrae) as well as two synostotic sections, the sacrum (os sacrum) and the coccyx (os coccygis). The thoracic vertebrae are in contact with the twelve rib pairs; the sacrum articulates with the ossa coxae. Within the spine, the stress in a standing position increases from cranial to caudal (Paulsen, 2018).

Our spine has 32 to 34 (see Figure 1) vertebrae (Paulsen, 2018).

The human spine consists of normal curves in the sagittal plane (lordosis and kyphosis) (Figure 2). The cervical lordosis develops with the ability to sit upright and the lumbar lordosis forms when learning to walk.

Function

The vertebral column supports the torso (i.e. the trunk). Together with the ribs, it gives the torso stability and protection, as well as flexibility in the lumbar region. There is a distinction between the internal muscles of the body wall (which only act on the body wall) and the muscles of the extremities (which originate from the body wall and act on the pectoral girdle and the limbs).

Another essential function of the spine is to protect the spinal cord.



Figure 1: Structure of the spine (Paulsen, 2018)

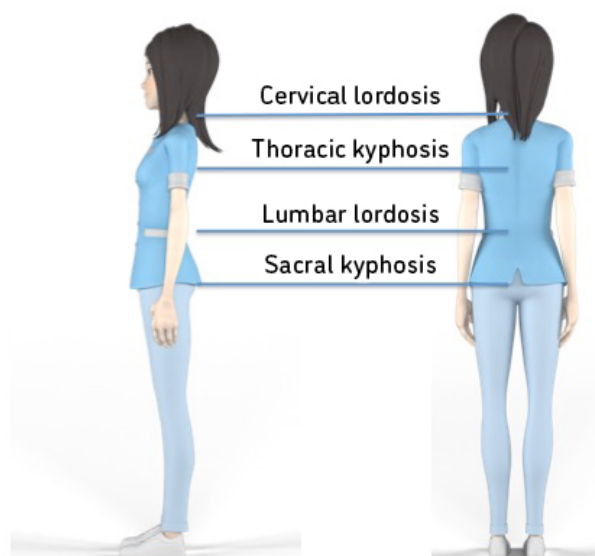


Figure 2: The spinal curves

2.2. Overview of a vertebral segment

A vertebral segment consists of (see figure 3 and 4):

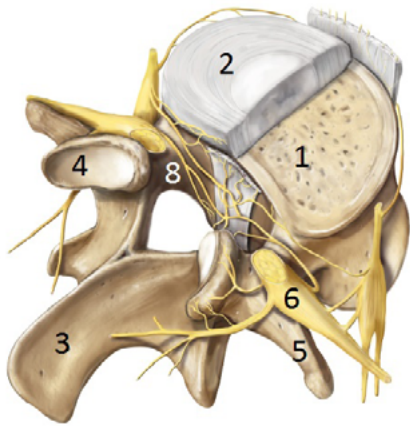


Figure 3: A vertebral segment, cross section (Paulsen, 2018)

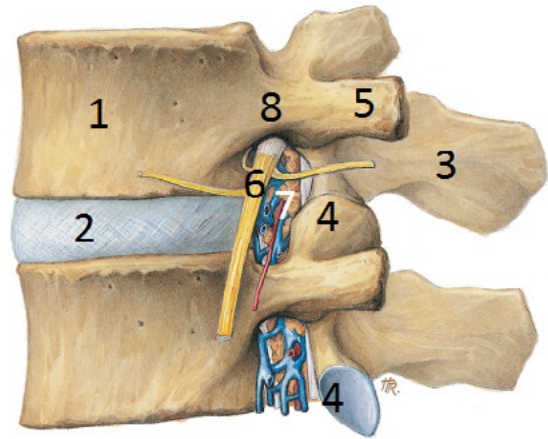


Figure 4: A vertebral segment (Paulsen, 2018)

1. Vertebral body
2. Intervertebral disc
3. Processus spinosus
4. Facet joints
5. Processi transversi
6. Nerves
7. Spinal cord
8. Laminae

2.3. Vertebra

A vertebra (Figure 5) consists of a vertebral body (corpus vertebra), two lateral projections (processi transversi), a rear projection (processus spinosus), and a vertebral canal (Paulsen, 2018).

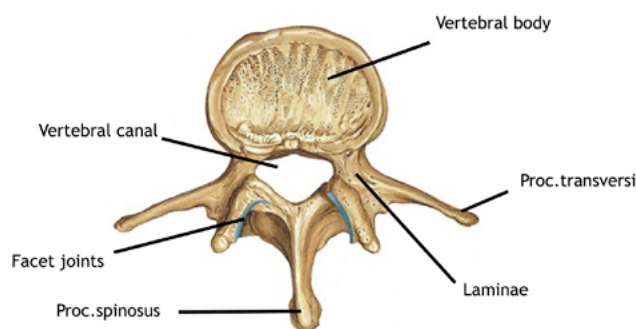


Figure 5: Components of a vertebra (Paulsen, 2018)

2.4. Facet joints

Anatomy

Each vertebra has an upper facet joint and a lower facet joint. These joints connect with the facet joints of the upper and lower vertebrae (Paulsen, 2018).

Function

The facet joints and intervertebral discs form the connections between two vertebrae. They function together during rotation and bending (Paulsen, 2018).

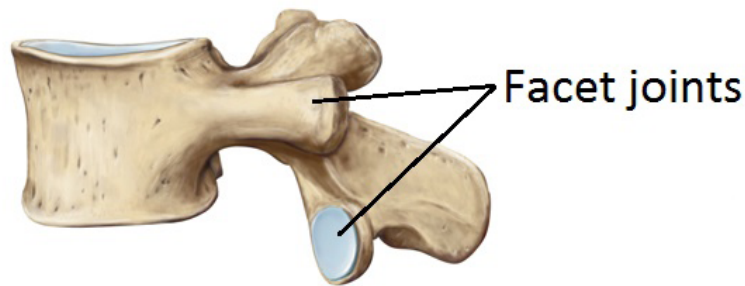


Figure 6: Facet joints of the vertebrae (Paulsen, 2018)

2.5. Intervertebral disc

Anatomy

Between two vertebrae, there is an intervertebral disc (Figure 7), except between the skull and the first vertebra, between the first and the second vertebra and at the height of the sacrum and the tailbone (Paulsen, 2018).

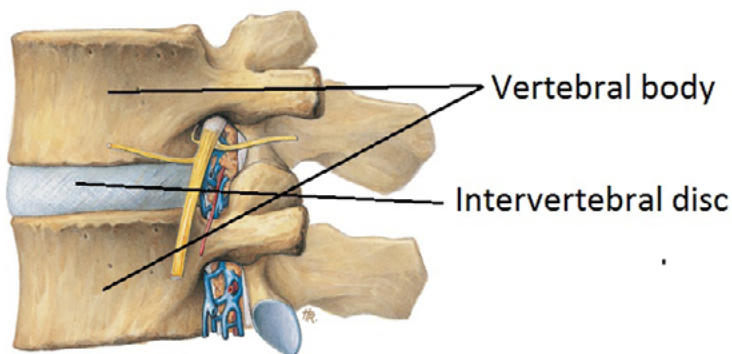


Figure 7: The intervertebral disc (Paulsen, 2018)

When we make a cross-section (Figure 8), we can observe the intervertebral disc (discus intervertebralis), which consists of a central gelatinous nucleus (nucleus pulposus) and a connective tissue ring (annulus fibrosus) surrounding the nucleus pulposus. The annulus fibrosus is largely affixed by a bony rim and hyaline cartilaginous coverage (Paulsen, 2018).

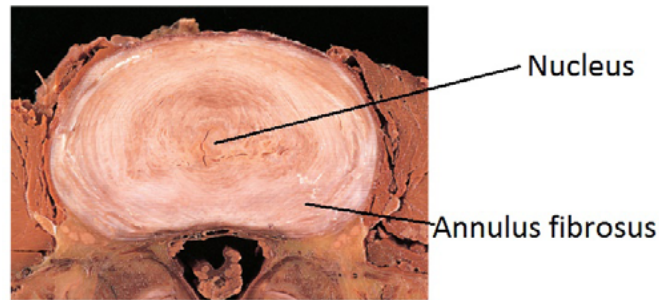


Figure 8: The intervertebral disc, cross section (Paulsen, 2018)

There is no blood flow. The metabolic environment of disc cells is governed by the avascular nature of the tissue. Because cellular energy metabolism occurs mainly through glycolysis, the disc cells require glucose for survival and produce lactic acid at high rates. Oxygen is also necessary for cellular activity, although not for survival; its pathway of utilization is unclear. Because the tissues are avascular, disc cells depend on the blood supply at the margins of the discs for their nutrients. The nucleus and inner annulus of the disc are supplied by capillaries that arise in the vertebral bodies, penetrate the subchondral bone, and terminate at the bone-disc junction. Small molecules such as glucose and oxygen then reach the cells by diffusion under gradients established by the balance between the rate of transport through the tissue to the cells and the rate of cellular demand. Metabolites such as lactic acid are removed by the reverse pathway (Grunhagen, Wilde, Soukane, Shirazi-Adl & Urban, 2006).

The disc gets its nutrition from blood vessels in the vertebrae. In the case of pressure reduction, such as in the supine position, the nutrient liquid returns from the vertebra to the intervertebral discs. It is important for the recuperation of these intervertebral discs that we lie down at least 8 hours each day (or night). In this position, the intervertebral discs can absorb the necessary nutrients so that they can withstand daily stress. Because of this, we are smaller in the evening than in the morning.

All of our body structures require blood flow in order to properly function. Limiting or even stopping the blood flow immediately reduces the functionality of these structures. Just think of a 'sleeping' foot. With movement, the foot is perfused and becomes functional again. Lack of movement and a sedentary life are high risk factors for our back (Grunhagen et al., 2006).

The intervertebral disc does not contain many nerves. Branches depart from the peripheral nerve to the outer edge of the annulus fibrosus (Figure 9) (Hochschild, 2015). These sensitive nerves are located in the outermost one-third of the annulus fibrosus. This innervation is more profound in a degenerated disc. Some fibers penetrate the nucleus (Huygen, Kleef, Vissers & Zuurmond, 2014). The intervertebral discs have the functions of absorbing impacts and pressure variations in the spine, and allow movement.

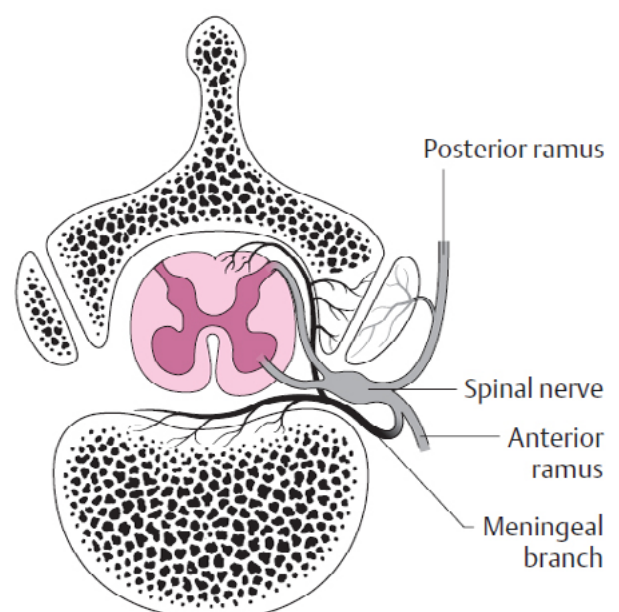


Figure 9: Annulus fibrosus (Hochschild, 2015)

2.6. Muscles

There are muscles all around the spine. Some muscles take care of our movements (e.g. bending over, turning and bending sideways) while others support our back; instead of, those are called our muscular corset (Paulsen, 2018).

Anatomy: ventral

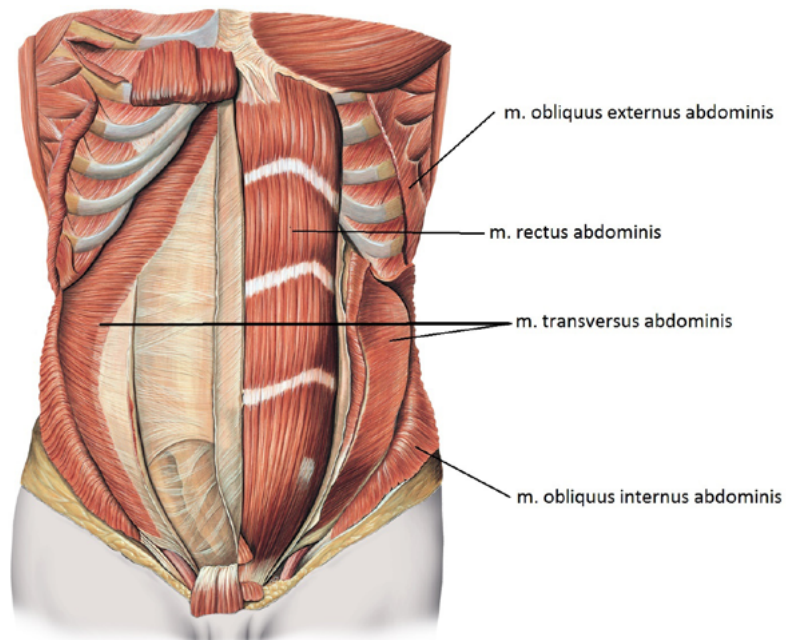


Figure 10: The ventral muscles (Paulsen, 2018)

Anatomy: dorsal

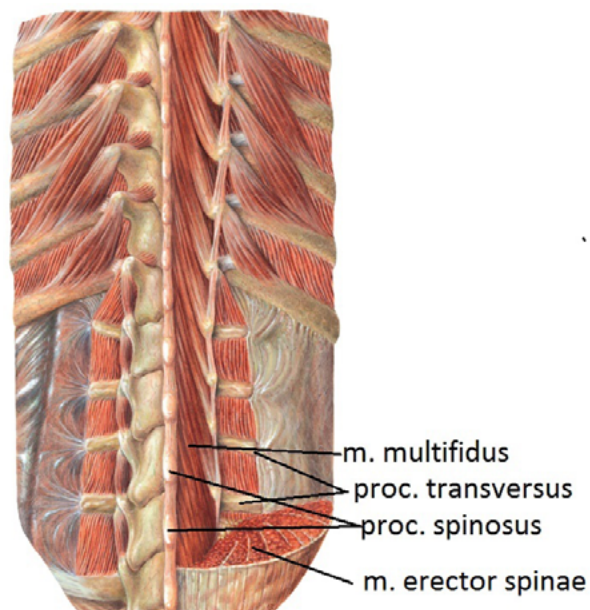


Figure 11: The dorsal muscles (Paulsen, 2018)

Function

The main abdominal and back muscles can be divided into two groups: the musculoskeletal (global) muscles (e.g. the straight abdominal muscles or m. rectus abdominis, the m. obliquus abdominis and the m. erector spinae), and the stabilizing (local) muscles, the most important of which are the m. transversus abdominis and the m. multifidus.

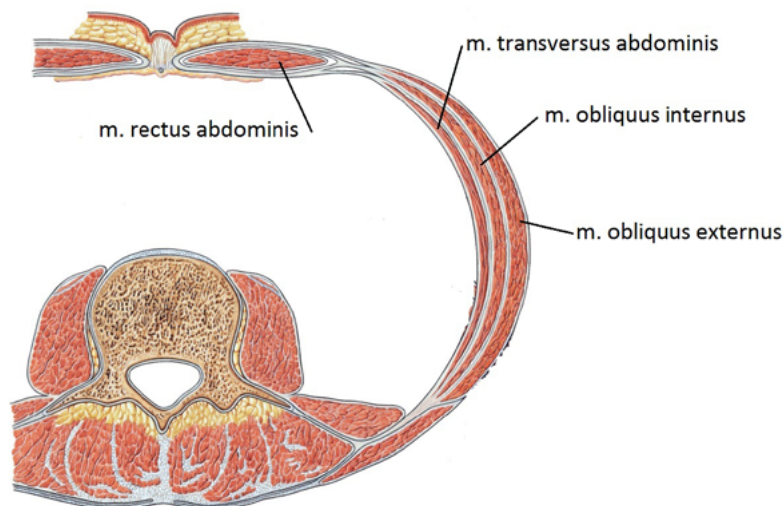


Figure 12: Stabilizing muscles of the spine (Paulsen, 2018)

The stabilizing muscles (Figure 12) increase the stability of the vertebrae. They help maintain posture and body position. The combined effect of the stabilizing muscles is comparable to wearing a corset. An external corset can also give support to our spine but has the disadvantage that muscle activity is limited. It is not recommended as a substitute because it weakens the muscles. Good back stability can reduce load and avoid recurring complaints (Paulsen, 2018).

At the back, we notice that the m. multifidus is close to the vertebrae. On the side, the m. transversus abdominis turns into a tendon leaf (fascia thoracolumbalis) and includes the back muscles.

2.7. Ligaments

When the spine is normally curved (slight hollow back lordosis), the muscles sufficiently support it. From the moment the spine starts bending and twisting, passive tissues, i.e. ligaments (Figure 13), become stressed. These ligaments protect the vertebrae from the shear forces while extremely bending forward and backward (McGill, 2016). The anterior and posterior longitudinal ligaments assist in the restriction of excessive forward and backward bending movements. The ligamentum flavum also belongs to the longitudinal ligaments. The ligamentum flavum lies posterior to the spinal cord and is a highly elastic structure.

Interspinous and supraspinous ligaments.

The interspinous ligaments resist posterior shear force of the superior vertebrae and control the vertebral rotation as it follows an arc throughout the bending action.

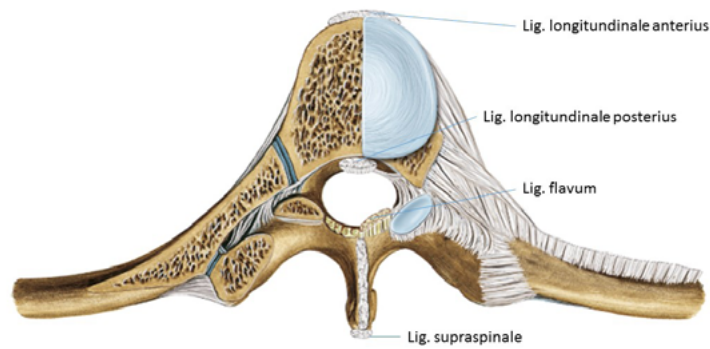


Figure 13: The ligaments of a vertebra (Paulsen, 2018)

2.8. Nervous system

Anatomy

From the brain, the spinal cord (Figure 14) goes through the spinal canal (formed by the vertebrae). The peripheral nerves leave the spinal cord and pass through a conjugation hole formed by two vertebrae.

There are three types of nerves: motor, sensory and sympathetic nerves. The motor nerves go to the muscles. The sensory nerves start from the skin, the muscles, the intestines, the ligaments, the joint capsules, and go to the spinal cord. The sympathetic nerves go from the spinal cord to the intestines, the blood vessels and the skin (Paulsen, 2018).

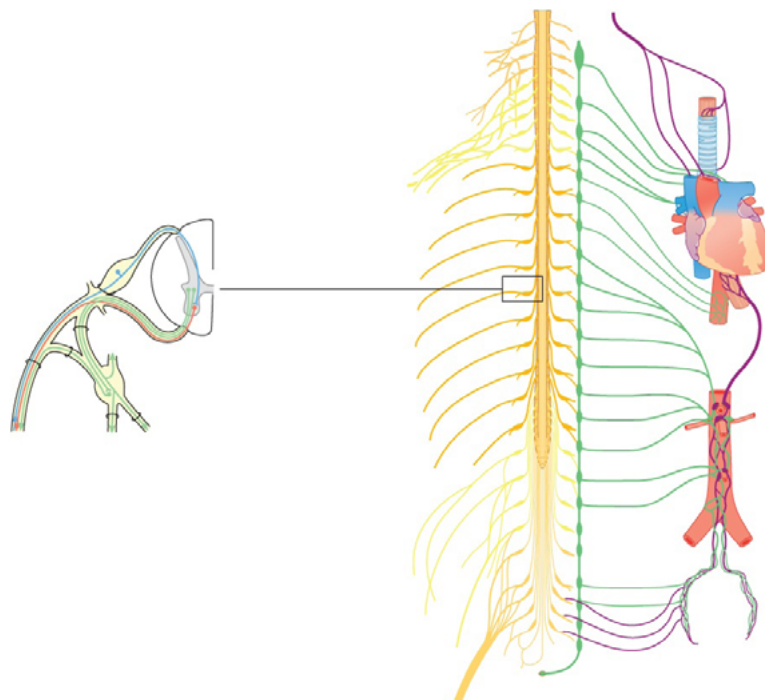


Figure 14: The nervous system (Paulsen, 2018)
 Yellow structures: central and peripheral nerves.
 Green structures: sympathetic nerve system.

Function

The motor nerves are responsible for contracting the muscles. The sensory nerves send signals of pain and feeling to the brain. The sympathetic nerves cause redness, sweating and contraction of the blood vessels (Paulsen, 2018).

2.9. Blood vessels

Anatomy – function

Both muscles and vertebrae contain blood vessels. The cardiovascular system consists of the heart and blood vessels (Figure 15). The most significant functions of the cardiovascular system are: to supply the organism of oxygen and nutrients, to support thermoregulation, to have a defense function, hormonal control, to control the haemostasis (Paulsen, 2018).

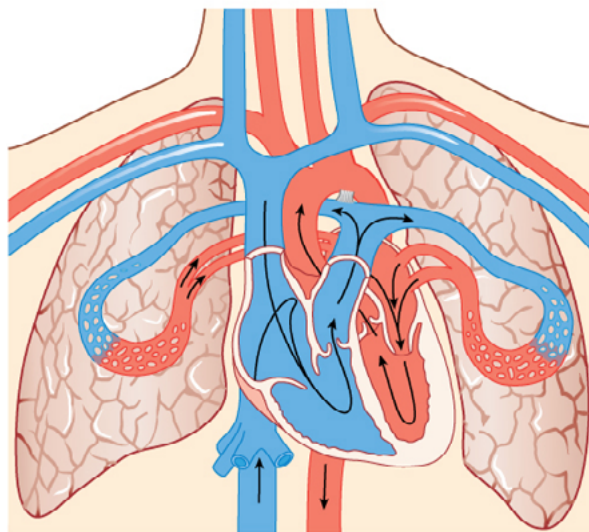


Figure 15: Blood vessels (Paulsen, 2018)

As said before (Intervertebral disc section), the intervertebral disc is avascular. The nucleus and inner anulus of the disc are supplied by capillaries that arise in the vertebral bodies (Figure 16), penetrate the subchondral bone, and terminate at the bone-disc junction (Grunhagen, Wilde, Soukane, Shirazi-Adl & Urban, 2006).

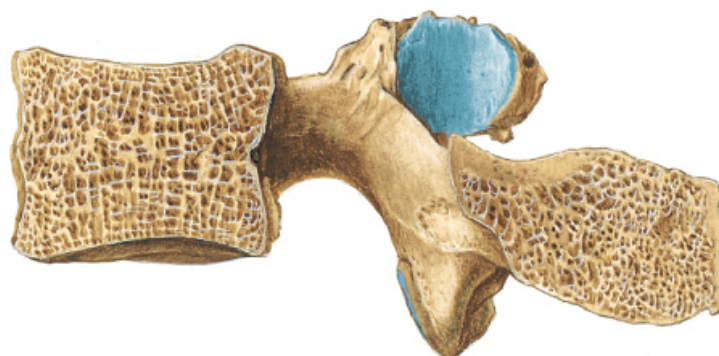


Figure 16: Nutrition of the blood vessels (Paulsen, 2018)

3. Biomechanics

Vandewalle, M., Goderis, T. & Ollevier, A.

3.1. Introduction

What happens inside the spinal column, specifically at the level of the intervertebral discs, while performing different movements? What is the effect of our posture or movements on the intervertebral discs?

3.2. What happens in the intervertebral disc during different movements

Forward bending

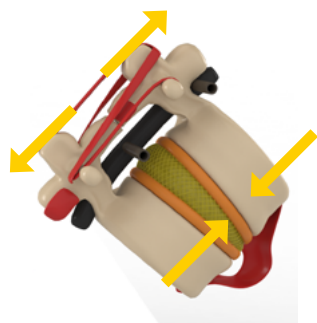


Figure 17: Forward bending in the spine



Figure 18: The spinal curve when bending over



Figure 19: Pressure on the vertebrae when bending forward

When bending forward, the space at the front between the vertebrae becomes smaller. The nucleus is moved backward so that the tension at the back becomes greater (Figures 17-18-19) (Kapandji, 2009).

The next postures (Figures 20-23) are postures where the disc is compressed at the front and are best avoided.



Figure 20: Spinal curve when crouching



Figure 21: Spinal curve when lifting with stretched legs



Figure 22: Spinal curve when lifting from a crouched position



Figure 23: Spinal curve when sitting stooped

Applied to the practice of caregivers, these figures show common movements. For example, when picking up something from the floor, tying one's shoes, putting on one's socks, lifting one's luggage, lifting a pack of laundry, or sitting stooped while talking or performing minor caregiving techniques.

Backward bending

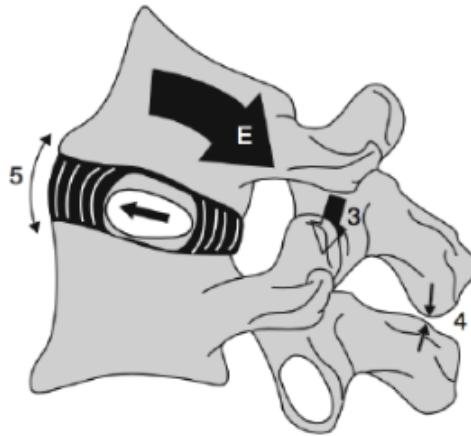


Figure 24: Vertebrae when bending backward

While bending backward, the space at the back between the vertebrae becomes smaller. The nucleus is moved forward so that the tension at the front becomes greater (Kapandji, 2009).

The next posture (Figure 25) is a posture where the disc is compressed at the rear and is best avoided.



Figure 25: Spinal curve when lifting overhead

Side bending

During a lateral bend, the nucleus is pushed to the other side (Figure 26) (Kapandji, 2009).

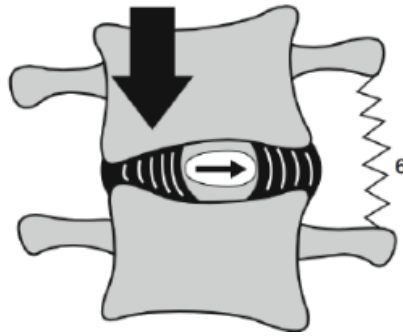


Figure 26: The vertebrae when bending to the side

Rotation

In the case of rotational movements (Figure 27), the upper vertebra rotates in one direction while the underlying moves in the opposite direction. As a result, the fibers of the ring become stretched, increasing the internal pressure (McGill, 2016).



Figure 27: Spinal curve when rotating to the side

Combination of forward bending and rotating: twist



Figure 28: Spinal curve when twisting



Figure 29: Spinal curve when twisting and lifting

The rings around the core of the intervertebral disc are at risk of breaking, and the core is pushed back through the cracks of the rings. Squeezing and compressing the intervertebral disc is very stressful (Kapandji, 2009).

The following Table 1 and Figure 30 show the degree of comfort for the most critical joints, in other words, the postures that lead to considerably more risk of joint injuries once their 'comfort level' is exceeded. When this happens, the joint structures, ligaments, tendons, and muscles are extended. The nerve structures can also be affected, either by stretching or by compression through the surrounding structures.

Legend			
Color Range of motion of the joint	Type	Description	Action
	Comfortable, acceptable	Minor or negligible risk	None
	Not recommended	Increased risk for all or some of the users.	Analysis and reduction of the risks.
	Unacceptable	Unacceptable risk for all users.	Adaptation of the workstation to improve the working posture.

Table 1: Comfort level for pressure in the spine



Figure 30: Comfort levels for pressure on the spine

In conclusion, different postures cause different pressures. The combination of forward bending and rotation creates the highest intradiscal pressure. These postures involve static load as well, please check the chapter concerning static load.

3.3. Forces on the lumbar spine

Because we are under the influence of gravity, our back is continuously loaded. Our body is resistant to this. The load on our back depends on our posture. When lifting an object, we have to take into account how we carry that object.

Constant loads on the back play an important role in back problems. During lifting, the forces created on the back can be divided into compression forces and shear forces (Figure 31).

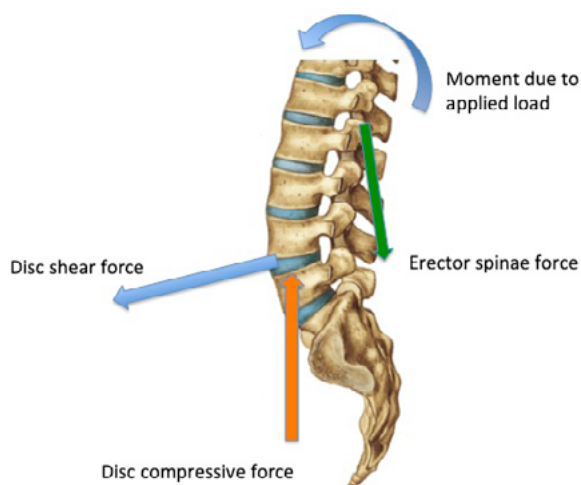


Figure 31: Forces on the lumbar spine

Compression forces



Figure 32: Standing posture: lateral view



Figure 33: Standing posture: frontal view

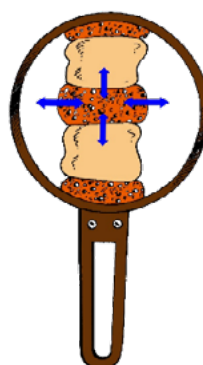


Figure 34: Standing posture, pressure on the spine



Figure 35: Standing posture, pressure on the disc

In a regular standing position (Figures 33-35), the inward and outward pressures are equal (Figures 34-35).



Figure 36: Standing with a heavy load

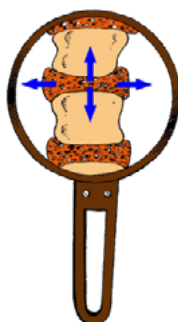


Figure 37: Standing with a heavy load, pressure on the spine



Figure 38: Standing with a heavy load, pressure on the disc

When carrying an object while standing (Figure 36), the outward pressure is higher, which compromises the disc (Figure 37-38).

For years, patient handling principles were based on a thesis from 1960 by Nachemson. His thesis described that the pressure on the human spine is lowest when lying down, whereas a much higher pressure is observed when bending over.

His thesis revealed that a sitting position gave a 40 % higher pressure than an upright standing position (Figure 39). Even though his thesis is considered controversial, the theory has become a globally accepted model to explain that back problems mainly develop during prolonged sitting (Humphreys & Eck, 1999).

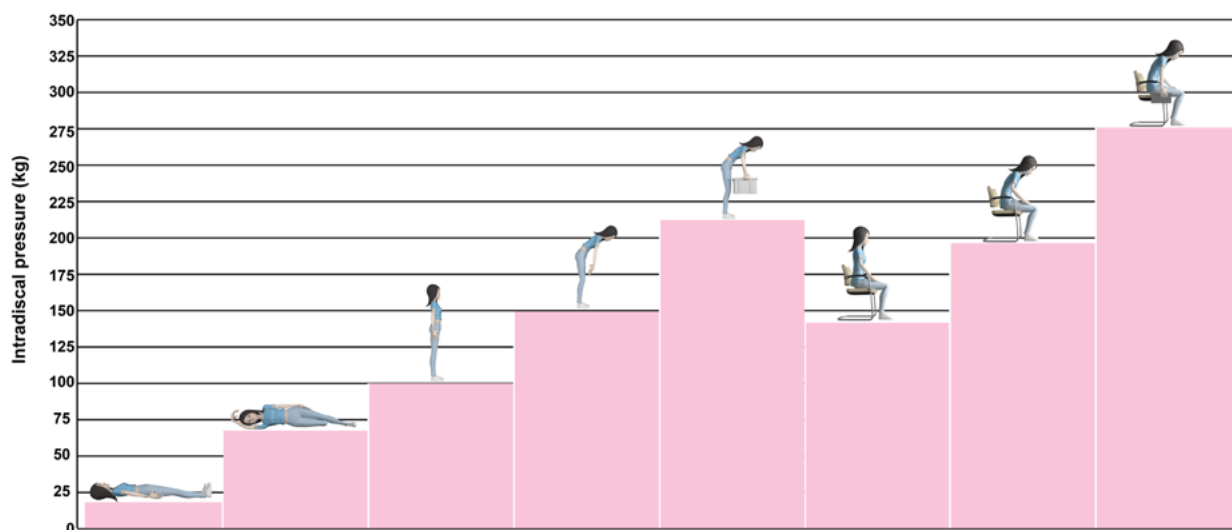


Figure 39: Compression force when lying, standing and sitting

Only 30 years later, new studies revealed that sitting still causes a lower pressure in the intervertebral discs than standing up (Snijders, 2000).

Smith and Pope observed a 12 % difference in intervertebral disc heights when the patient was lying down vs. standing (Smith and Pope, 2002). In a healthy lumbar disc, in vivo pressures in the nucleus are between 460 and 1330 kPa in a sitting position, 500 and 870 kPa in a standing position, and 91 and 539 kPa when lying either prone or supine (Nachemson & Morris, 1964; Sato, Kikuchi & Yonezawa, 1999; Wilke, Neef, Caimi, Hoogland & Claes, 1999). The highest pressure in the nucleus (2300 kPa) was recorded in a standing subject, who was flexing forward while holding a 20 kg weight (Wilke et al., 1999). Today, new techniques exist, like upright MRI scanners that can measure the behavior of intervertebral discs in an erect or semi-erect position (Lewis & Fowler, 2009).

At this point, we can conclude that the lying position gives minimal intradiscal pressure.

Slightly bending forward already increases the intradiscal pressure considerably.

However, since it is not yet clear which position causes the highest intradiscal pressure (sitting or standing), further research is still needed.

Shear forces

The shear forces are the greatest on the lower 2 vertebral segments, namely L4-L5 and L5-S1, because while standing, these vertebrae are at an angle of approximately altogether 30 ° with respect to the horizontal. The intervertebral discs and back muscles are not resistant to high shear forces. When damage is already present on the laminae, there is a greater possibility of shearing the vertebrae.

The principal of balance of lever

Our back works like a lever, as illustrated in Figures 40 to 42.

On average, there is a pressure of 40 to 50 kg on the lower back depending on the size and weight of the patient (two-thirds of the body weight). When lifting a load, the pressure varies with the method the load is lifted. The further away from the body one carries a weight, the higher the load on the back (Figure 43). The load on the back also increases when bending forward (Figure 44).



Figure 40: Demonstration of leverage

Figure 40 demonstrates the rule whereby << load x load arm = power x power arm. >>

With two equal load arms (i.e. at the same distance) and two equal weights, the load on the point of application is equal to the sum of both weights (Figure 41).

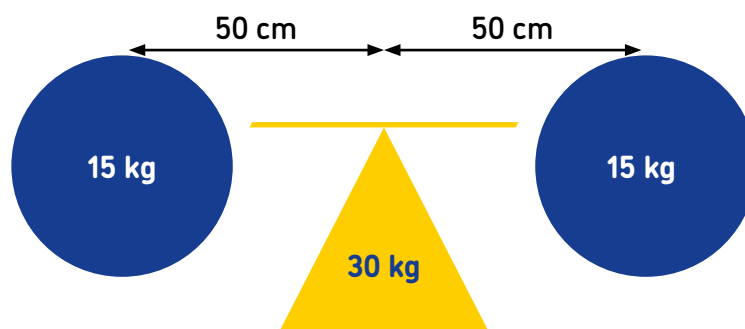


Figure 41: The principle of a lever with equal loads

With two unequal load arms, the ratio (coefficient) between the load arms (Figure 42) is important.

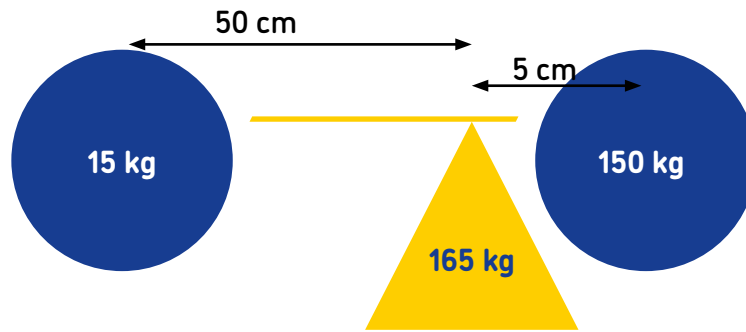


Figure 42: The principles of a lever with unequal arm loads

Lever principle applied to the human body: our back works like a lever, as illustrated in Figures 40-42. Note that there are many kinds of levers in the human body, as a 2nd class lever in the ankle area and a 3rd class lever in the arm. However, our interest here is about 1st class levers which are the ones present in the spine.

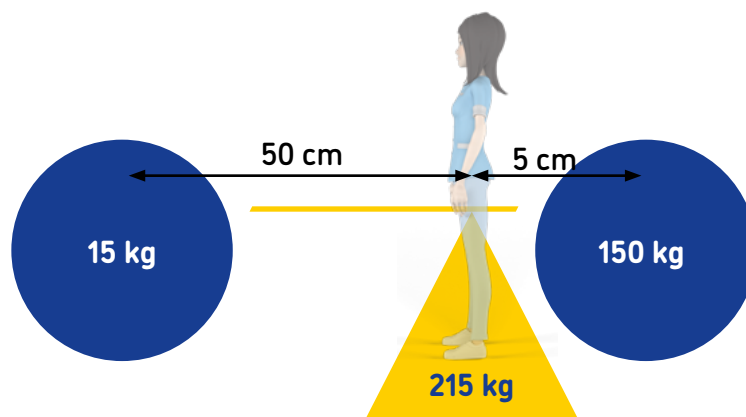


Figure 43: The lever principle applied to the human body

- The lever corresponding to the distance between the disc and the load = 50 cm.
- The lever corresponding to the distance between the disc and the paravertebral muscles = 5 cm.
- The contractile force of the paravertebral muscles = 150 kg.
- The weight of the load = 15 kg.
- The weight of the upper body, head, and upper limbs = 50 kg (for a person weighing 75 kg).
- The pressure on the support surface P (sides the disc L5-S1): $150 \text{ kg} + 15 \text{ kg} + 50 \text{ kg} = 215 \text{ kg}$.

The following situation demonstrates the loads when bending forward at an angle of 90°, flexing the back, without carrying a load.

The lever corresponding to the distance between the disc (L5-S1) and the center of gravity of the upper body = 20 cm.

The lever corresponding to the distance between the disc and the paravertebral muscles = 4 cm (this position is weaker than in an upright posture because the paravertebral muscles are brought closer to the disc when the spine is round).

The weight of the upper body, head, and upper limbs = 50 kg.

Constriction of the muscles = 250 kg.

The pressure on the support surface P (e.g. disc L5-S1) = 250 kg + 50 kg = 300 kg.

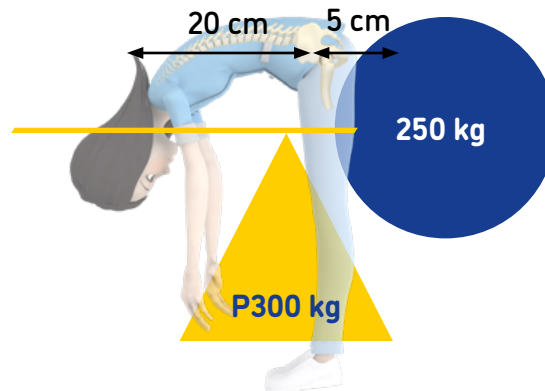


Figure 44: The lever principle when bending forward

In conclusion, the force applied to the spine is influenced by:

- The weight of the load: the heavier the load, the more pressure on the back.
- The posture of the body: the more the torso is bent forward, the higher the load on the back, the higher the disc compressive force and disc shear force.
- The distance between the load and the body: the further away from our body, (Figure 45), the more pressure there is on our intervertebral disc, the more our muscles have to work to carry the object, and the more strength you need to lift it.



Figure 45: A load not kept close to the body

Example: Table 2 shows an overview of the pressure on the lower lumbar intervertebral disc for a person weighing 75 kg.

	Weight of the load (in kg)				
	0	10	15	25	50
Body vertical and load against the body.	50	110	140	200	350
Body vertical and load with arms straight.	50	210	290	375	850
Body 45 ° bent forward.	250	335	375	460	675

Table 2: Weight of the load (Goderis, 2017)

This means that we have to keep a load as close as possible to our body, and bend as little as possible. It is recommended not to lift any heavy load if this can be avoided (Goderis et al., 2017).

4. Pathology and dysfunction

✍ Vandewalle, M., Goderis, T. & Ollevier, A.

4.1. Non-specific low back pain: muscular insufficiency

When addressing the causes of back pain, the multi-factorial aspect appears, and the concept of non-specific back pain may arise. Non-specific low back pain (LBP) is back pain for which we cannot find any specific cause (van Tulder & Koes, 2013). Some experts have found that for up to 80 to 95 % of people with LBP, a specific cause for their condition cannot be identified, whereas some others state that there is no such thing as non-specific back pain (and that there should be more thorough assessments) (McGill, 2016).

Without adding to this debate, we want to point out the softer tissue changes, in e.g. muscles, tendons, and ligaments, which can have a cascading effect and lead to damage and pain, resulting in an intolerance towards certain activities (McGill, 2016).

Figure 46 illustrates the vicious cycle of muscular insufficiency.

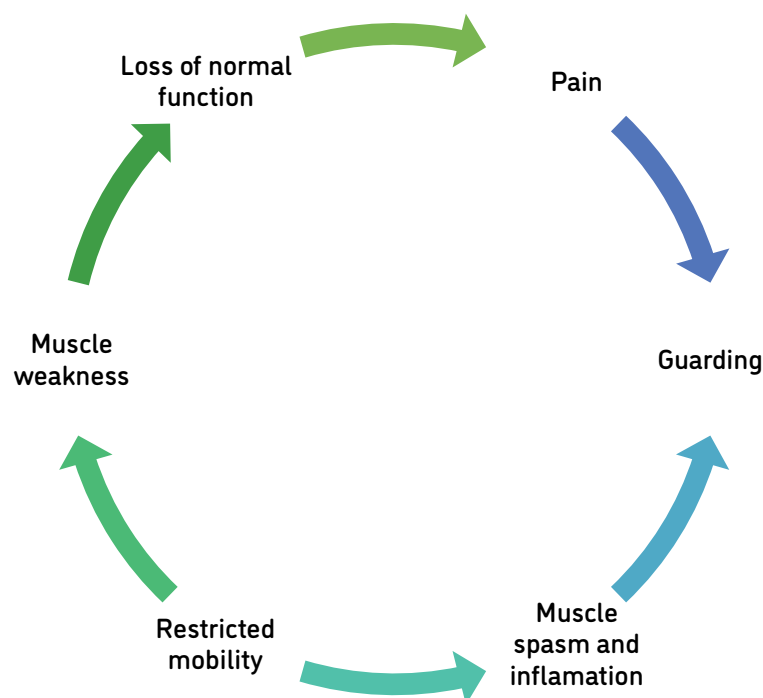


Figure 46: The cycle of muscular insufficiency

Pain usually goes hand in hand with back conditions, as it is an indicator of a problem. Chronic pain can influence daily activities such as sport and work (Huijnen, 2011).

4.2. Deformations

Lumbar lordosis

Decreased lumbar lordosis increases the load on the intervertebral discs, and increased lordosis increases the load on the facet joints (Murray, Le Grande, Ortega de Mues & Azari, 2017). A review on the relationships between low back pain and lumbar lordosis revealed a strong relationship between LBP and decreased lumbar lordosis (Chun, Lim, Kim, Hwang & Chung, 2017).

The primary postural curves of the spine (including the lumbar lordosis) allow for optimal weight bearing on the spinal joints. Changes in the magnitude of lumbar lordosis significantly change weight-bearing patterns in lumbar facet joints and intervertebral discs. It is therefore plausible that significant changes from the 'optimal' degree of lumbar lordosis could overload spinal joints and influence the development or progression of degenerative joint disease (Murray et al., 2017).

Scoliosis

Definition

'Skolios' is a word derived from the Greek language which means crooked or curved.

Scoliosis is a general term comprising a heterogeneous group of conditions consisting of changes in the shape and position of the spine (Figure 47), thorax and trunk in the frontal plane. We can divide scoliosis in functional and structural scoliosis.

Idiopathic (without a specific cause) structural scoliosis has been described as a torsional deformity of the spine, with several torsional regions joined by a junctional zone, every region including a variable number of morphologically lordotic vertebrae translated and rotated to the same side (Negrini et al., 2018). It occurs in apparently healthy children and can progress in relation to multiple factors during any rapid period of growth.

Functional scoliosis is a spinal curvature secondary to known extra spinal causes (e.g. shortening of a lower limb or paraspinal muscle tone asymmetry). It is usually partially reduced or completely subsides after the underlying cause is eliminated (e.g. in a recumbent position) (Negrini et al., 2018).

Epidemiology and cause

Scoliosis occurs in about 0.2 – 0.6 % of the general population, and in the majority of cases, its cause remains unidentified. Its dominant features are its spontaneous development during the growth of the child and its progressive tendency. Other possible origins could be genetic, environmental, hormonal, metabolic, biochemical, neurological, and asymmetric growth. A definitive cause for idiopathic scoliosis remains to be identified. Scoliosis is most likely a multifactorial condition with predisposing genetic factors (Latalski et al., 2017; Negrini et al., 2018).



Figure 47: Scoliosis (Modi et al., 2009)

Treatment

Different gradations of scoliosis exist, expressed by the term Cobb angle. The Cobb angle is the angle between the crossed lines using the most tilted vertebrae above and below the apex of the curve (Keenan et al., 2014).

With a Cobb angle below 30° , conservative treatment is the conventional therapy for scoliosis. If the scoliosis angle at completion of growth exceeds a critical threshold (most authors assume it to be between 30° and 50°), there is a higher risk of health problems in adult life, decreased quality of life, cosmetic deformity and visible disability, pain, and progressive functional limitations (Negrini et al., 2018). In general, curves beyond 45° and 50° should be treated by surgery (Yaman & Dalbayrak, 2014).

4.3. Disc pathology

Disc pathology is divided into different grades of severity, based on the progress of (continuous) degeneration, as described and illustrated below.

Degenerative disc

With repeated bending movements or bending-turn movements with too large of an amplitude, small cracks can occur in the fibers. These cracks are not painful but create a zone that is less resistant mechanically, at the level of the ring.

Figure 48 shows the intact state of a disc of a person younger than 15 years.

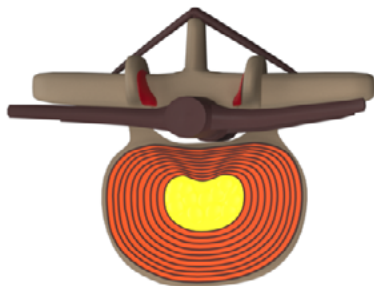


Figure 48: Healthy disc

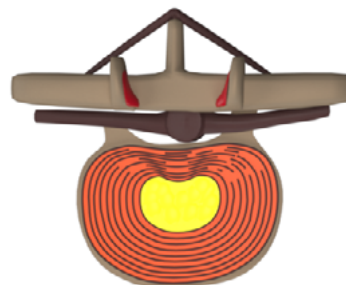


Figure 49: Degenerative disc

Due to degeneration of the disc, e.g. by ageing, the core of the intervertebral disc decreases because of dehydration (Figure 49). This is a normal physiological process which does not have to be painful. Only when cracks form in the outer ring, and the nerves get irritated, pain can develop.

Because the discs dehydrate, they become thinner. That is why humans shrink with age.

Bulging disc

The core seeps through these cracks and progresses to the edge of the ring as a result of further unfavorable movements. This can lead to swelling of the ring. Because of this, the rear part of the ring is subject to tension (Figure 50), which in turn can cause pain.

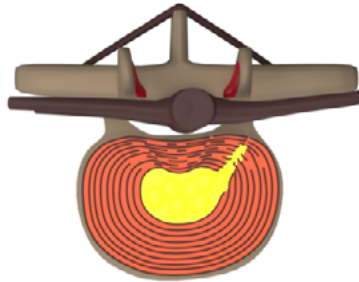


Figure 50: Bulging disc

Herniated disc

The annulus has become very fragile, and a simple movement can tear the last parts of the ring, causing part of the ring to bulge out of the core. This condition is called a hernia (Figures 51 and 52).

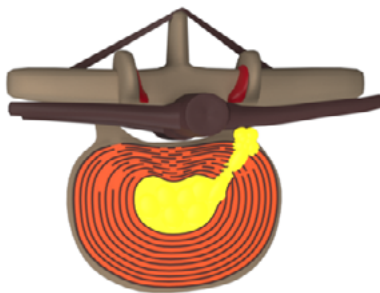


Figure 51: Herniated disc



Figure 52: MRI shows herniated disc (Paulsen, 2018)

4.4. Nerve pathology

Sciatica

Sciatica is pain which radiates along the leg. It can radiate in the front, back, or side (lateral) of the leg.

Sciatica can be caused by putting tension on the sciatic nerve, on the lumbar nerve roots, or within the cauda equina, by pinching at numerous locations along their length, or because of irritation from rough surfaces, e.g. arthritic bone or extruded disc material (i.e. hernia).

The symptoms are different and range from radiating pain to sensations in the leg or foot. The presence of back pain is possible but not necessary (McGill, 2016).

Spinal stenosis

Degenerative lumbar spinal stenosis is defined as a focal narrowing of the spinal canal, although there is some variation among researchers about the precise amount of narrowing that must occur before the canal is considered stenotic.

Patients with symptomatic spinal stenosis typically have chronic low back pain and pain and weakness in the legs, limiting their ability to stand and walk to brief durations and short distances (Snyder, Doggett & Turkelson, 2004).

4.5. Bone pathology

Osteoporosis

Osteoporosis is a systemic skeletal disorder in which the micro-architecture of the bone tissue becomes deteriorated, leading to decreased bone mass, fragility, and thus increasing the risk of fractures (Garg, Dixit, Batra, Malhotra & Sharan).

The osteoporotic vertebra is characterized by mineral loss and declining bone density in the trabeculae, especially the transverse trabeculae. The osteoporotic vertebra begins to slowly collapse when exposed to excessive load developing the classic wedge shape (McGill, 2016).

Osteoarthritis/osteophytes, general degeneration of the spine

Degenerative joint disease (DJD) in the spine, also known as osteoarthritis (OA) affects approximately 80 % of the population aged 40 and above. It also has a complex association with chronic low back pain and hence amounts to a significant health burden. Even though the etiology and pathogenesis of DJD are in need of further investigation, several risk factors for this condition were identified. These factors include abnormal or excessive joint loading, e.g. as occurs in obesity or excessive occupational standing or lifting; trauma; birth defects; and genetic predisposition. Of these, excessive or abnormal joint loading is the most readily modifiable risk factor (Murray et al., 2017).

Over the years, the cartilage of the joints can wear out as a result of repeated movements. The shock absorbing tissue no longer protects the underlying bone, which reacts to the felt pressure, and develops small protuberances called osteophytes. As time passes, the core dehydrates, and the disc becomes thinner. This process is called disc drop (Figure 53).

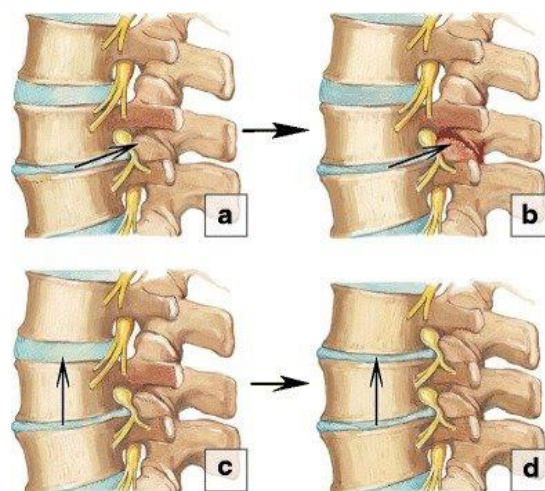


Figure 53: Disc drop

Types of spinal degeneration. (a-b) Horizontal degeneration. Initial degeneration of the intervertebral disc (a) subsequently leads to facet joint osteoarthritis (b). (c-d) Adjacent segment disease. Severe degenerative changes on a segment result in abnormalities in the level above (Kushchayev et al., 2018).

■ Compression fracture

A compression fracture (Figure 54) is usually defined as a vertebral bone in the spine that has decreased at least 15 to 20 % in height due to fracture. Vertebral compression fractures can occur anywhere in the spine, but are most commonly observed in the upper back (thoracic spine), particularly in the lower vertebrae of that section of the spine (i.e. T10, T11, T12). They rarely occur above the T7 level of the spine. They often occur in the upper lumbar segments as well, such as L1.

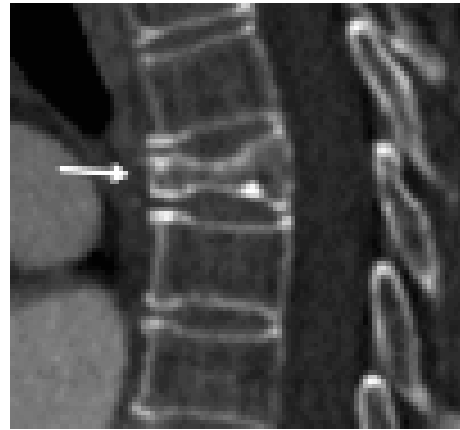


Figure 54: Vertebral body compression (Burns et al., 2017)

A spinal fracture due to osteoporosis (weak bones) is commonly referred to as a compression fracture, but can also be called a vertebral fracture, osteoporotic fracture, or wedge fracture. The term wedge fracture is used because the fracture usually occurs in the front of the vertebra, collapsing the bone in the front of the spine and leaving the back of the same bone unchanged. This process results in a wedge-shaped vertebra. A wedge compression fracture generally has a mechanically stable fracture pattern (Burns, Yao & Summers, 2017).

■ Spondylolysis/listhesis

Spondylolysis is an anatomical defect or fracture of the pars interarticularis of the vertebral arch. The defects can occur unilaterally or bilaterally. Spondylolysis is one of the most common causes of lower back pain in adolescents, although it remains asymptomatic in the majority of patients. Spondylolysis (Figure 55) can progress into spondylolisthesis, which is defined as the anterior displacement of the vertebral body in reference to the adjoining vertebral bodies (Kushchayev et al., 2018).



Figure 55: Spondylolisthesis (Kushchayev et al., 2018)

4.6. Failed back surgery

The international association for the study of pain defines failed back surgery syndrome (FBSS) as follows:

“Lumbar spinal pain of unknown origin either persisting despite surgical intervention or appearing after surgical intervention for spinal pain originally in the same topographical location.” (Harvey, 1995)

5. Pain education

Meijer, B., Mingaila, S. & Vandewalle, M

As explained in the previous section, pain is a usual companion of back conditions, because it is indicative of a problem. The usual chronification of pain is often a big problem. It can limit one's daily activities and work.

5.1. Definition

Definition of pain in adults:

"An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." (WHO, 2012)

5.2. Physiology of pain

Nervous system

We can divide the nervous system into two parts (Butler & Moseley, 2003), the central nerve system and the peripheral nerve system (see Figure 56).

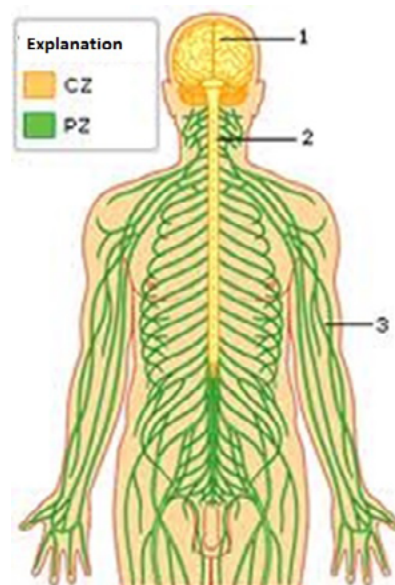


Figure 56: Nervous system for pain

Pathway of the stimulus

Sensors at the end of the peripheral nerve (e.g.: skin)

Each nerve cell has different sensors or receptors. Each sensor is specialized to take one type of stimulus. This stimulus can be chemical (a), thermal (t) or mechanical (m) in nature (Figure 57).

As soon as a specific stimulus occurs, the gate of the receptor opens, allowing positive charges from outside to inside the nerve cell.

When there are sufficiently positive charges, they are converted to electrical stimuli, which are transported through the nerve to the spinal cord (Butler & Moseley, 2003).

Comparable to the conduction of electricity along an electrical cable, the stimulus is guided along the path of the nerve to the spinal cord (Figure 58).

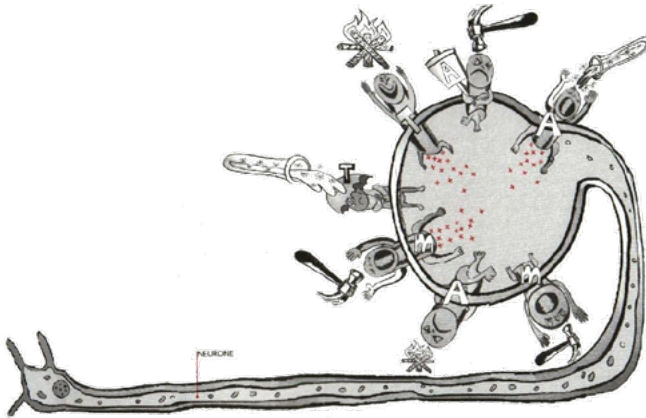


Figure 57: The stimulus of pain

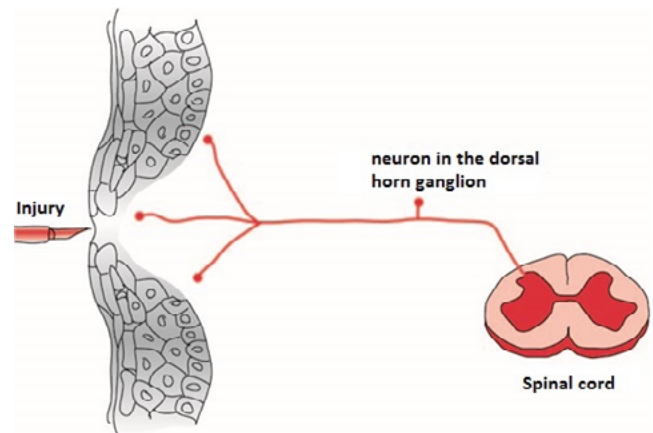


Figure 58: The stimulus from injury

Spinal cord

The stimuli get transported from the peripheral nervous system to the spinal cord. Neurotransmitters support the transmission (Figure 59).

The intensity of the passed stimulus may be affected by messenger substances from the brain and other nerve fibers. These messenger substances work as a volume control: they may enhance or weaken the signal (Butler & Moseley, 2003).

Enhance: a cut on the finger has a greater impact on a violin player than on someone else. This person can perceive more pain.

Weaken: a cyclist who has broken the clavicle as a result of a fall can often continue the ride without feeling extreme pain.

The body has a robust internal system to control pain. This internal control system is believed to be 60 times stronger than any drug.

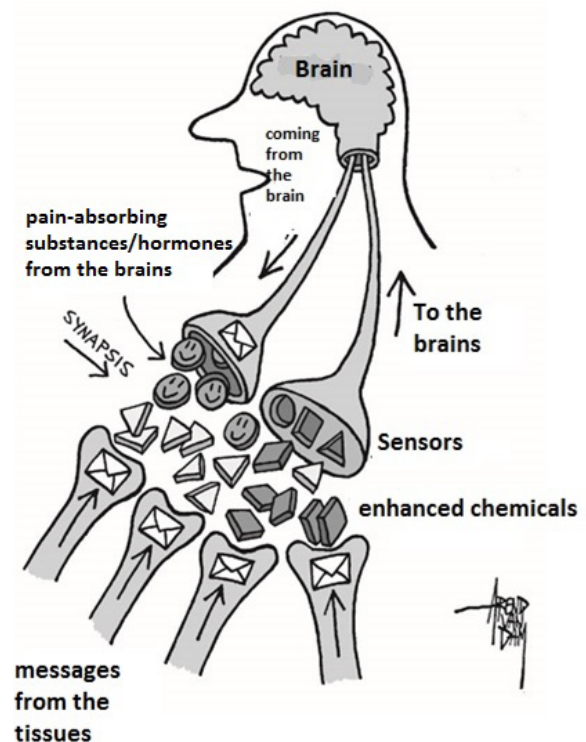


Figure 59: Transportation of pain stimuli

Brain

Only when the brain has processed the pain stimulus and has decided that pain is the consequence for this pain stimulus, does the individual experience pain (Figure 60) (Butler & Moseley, 2003).



Figure 60: No brain no pain

5.3. Acute pain

Acute pain is directly related to soft tissue damage such as a sprained ankle or a paper cut.

Acute pain is necessary to warn the body about danger: it is a natural protection mechanism, meant to make one react appropriately. It is of short duration and gradually resolves as the injured tissues heal. Acute pain is distinct from chronic pain and is relatively more sharp and severe (Butler & Moseley, 2003).



Figure 61: Acute pain

5.4. Chronic pain

Chronic pain is a persistent or recurrent pain lasting longer than 3 months (WHO, 2012). Pain sensation without damage is possible. Additionally, the damage is not equal to pain and pain is not equal to damage (Butler & Moseley, 2003).

In chronic pain there are physiological changes in the transport and transmission of the stimulus on different levels.

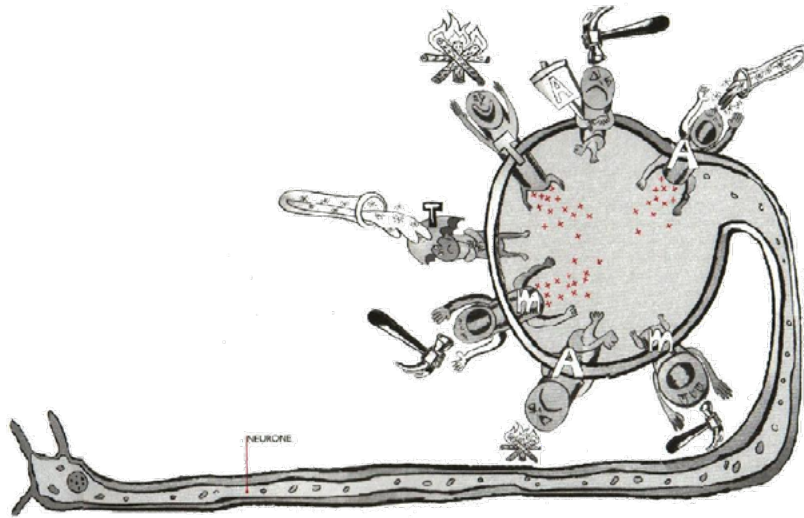


Figure 62: Chronic pain

The spinal cord adapts

In a normal situation, one stimulus in the spinal cord equals one stimulus in the brain (Figure 63). In patients with chronic pain, the volume control system fails and stays open. If three stimuli enter the spinal cord, they are converted into five stimuli to the brain. We call this central sensitization. In this situation, one stimulus or no stimulus enters the spinal cord, and many stimuli are transported to the brain. Thus patients with central sensitization can feel pain without there being damage (Butler & Moseley, 2003; van Wilgen & Nijs, 2010).

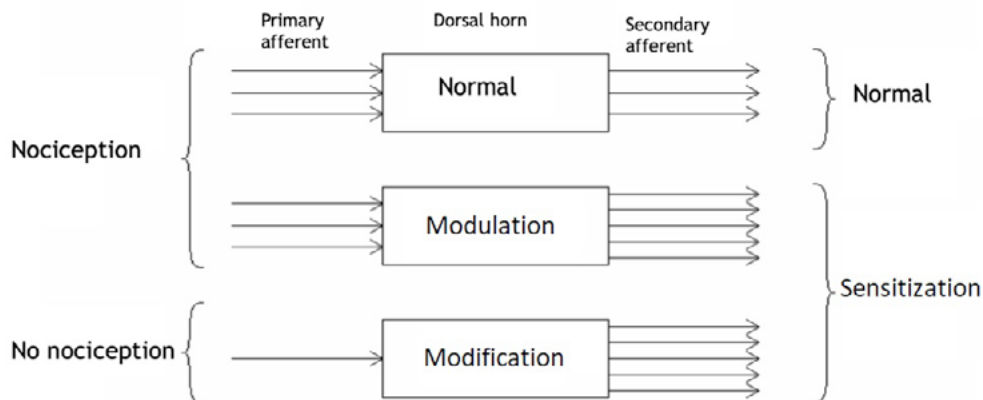


Figure 63: Adaptation of the spinal cord

Pain program in the brain

Everyone has a pain memory. This memory holds every interpretation of a stimulus. When there are too many stimuli in the pain memory, one can feel pain even though there is none. Treatment is aimed at improving the quality of life (van Wilgen & Nijs, 2010).

6. Postures

Ollevier, A., Goderis, T. & Vandewalle, M.

In understanding postures, we delve into the dynamics of our spine's curvature, essential for maintaining physiological balance and distributing daily forces efficiently. Exploring how the spine's natural curves evolve from early development to adulthood sheds light on their crucial role in providing stability during various healthcare tasks.

6.1. Physiological curvatures of the back

In the sagittal plane, the spine exhibits characteristic curves (Figure 64):

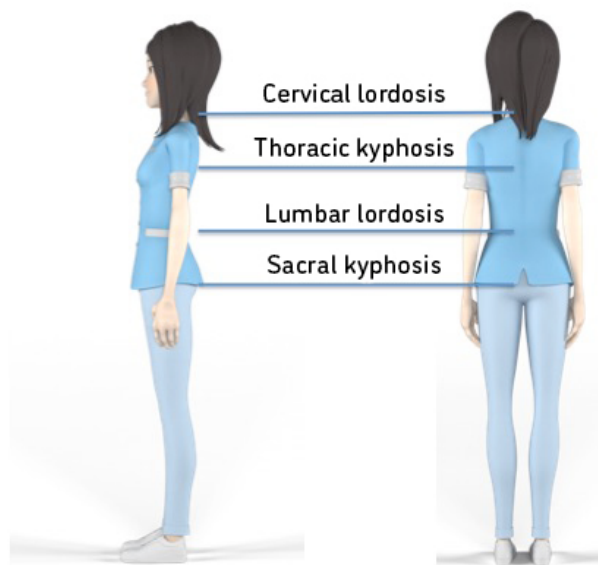


Figure 64: The spinal curves

Lordosis is the medical term for a ventrally-facing convex curvature of the spine, and kyphosis when it is dorsally-facing. In the first few months after birth, all sections of the vertebral column exhibit a dorsal convex bend. The cervical curve forms when sitting, the lumbar curve when running.

The curves only form when the pelvis is tilted forward in relation to the biped walk in the 1st two years of development. Before this time the entire vertebral column is bent in all sections to the rear convex (Paulsen, 2018).

A physiological posture is essential for distributing the daily forces evenly throughout our body. The spinal column offers the best resistance and the pressure at the level of the intervertebral disc is evenly distributed. In this position, the muscles work most efficiently, and the load on muscles, vertebrae, intervertebral discs and ligaments is evenly distributed.

Even in nature, curves are common. Animals like cats or horses have a curved spine, and plants are never straight.

The physiological curves of the back consist of a slightly hollow lower back, a slightly convex upper back and a slightly hollow neck. Spine curvature, especially the slight hollow lower back, ensures shear stability during flexed weight-holding tasks (McGill, 2016).

Deviations from the physiological curvatures can have different consequences.

If we want to work in a more “back-friendly” way, we must first be more aware of our own body, and be able to feel and control it. We have to experience for ourselves whether our back is in the correct physiological position. That is why body awareness is so important. We want to strive as much as possible towards a physiological posture. To achieve this correct attitude we make a pelvic tilt (i.e. a rolling movement). This can be done, depending on the initial posture, by bringing the pelvis to the front (anteversion) or by bringing the upper edge of the pelvis to the back (retroversion):

To do so, we start by lying on our back with our knees bent. This way our lower back is already less hollow (Figure 65). We bring our lower back to the ground. Now we bring back the top edge of our pelvis (= retroversion of the pelvis, Figure 66). Note that the movement does not happen from the upper back. After that, we release our lower back from the ground and do the opposite. We make the lower back more hollow by bringing up the upper edge of our pelvis (= anteversion, Figure 67). When tilting the pelvis, the abdominal hip flexors and the buttock muscle hip pullers work together (Goderis et al., 2017).

Supine position

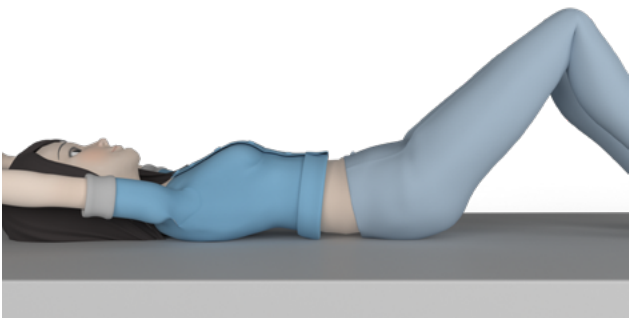


Figure 65: Neutral position when lying down

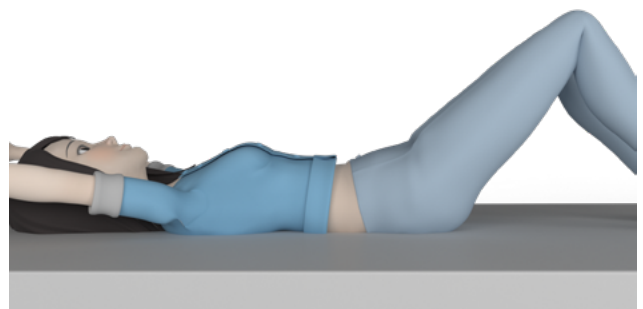


Figure 66: Retroversion of the pelvis

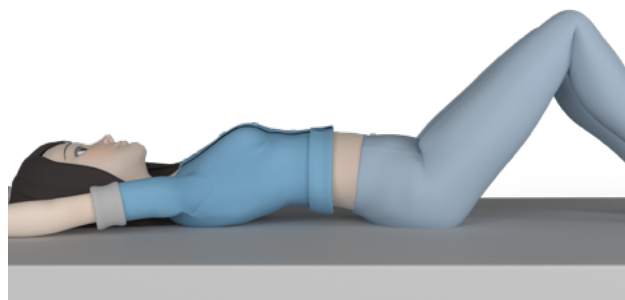


Figure 67: Anteversion of the pelvis

Standing position

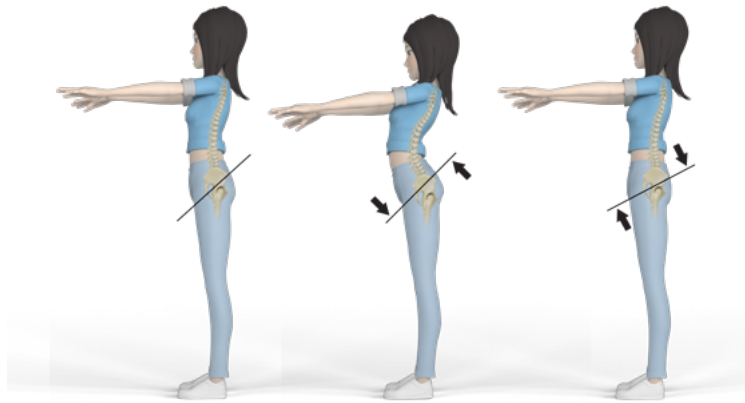


Figure 68: Standing, position of the pelvis

6.2. Standing

Frontal



Figure 69: Standing, frontal view

Lateral

Correct posture (side view, Figure 70) is obtained by a perpendicular line from the ear to ankle.

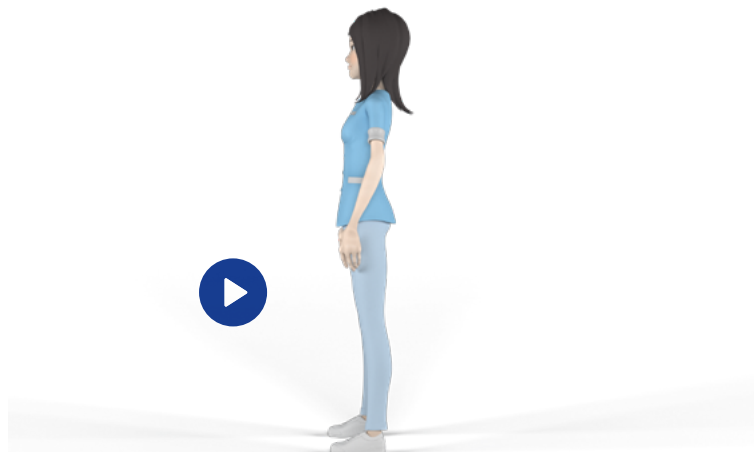


Figure 70: Standing, lateral view

6.3. Active sitting

A correct sitting posture (Figure 71) is essential. Especially when sitting on a chair for an entire day, a correct sitting position can minimize the strain on one's back (Goderis et al., 2017). Foremost, keep in mind that sitting on a chair all day long is not a good idea. Try to switch position every 20 minutes and take minibreaks as much as possible. Microbreaks are postural changes: lifting your feet, sitting more in front of the chair, lifting a leg and quickly get up.

Figure 71 is demonstrating an active sitting method, without using back support.



Figure 71: Active sitting

6.4. Stabilization

Introduction

Spinal stability is the ability of the spine under physiologic loads to limit patterns of displacement so as not to damage or irritate the spinal cord and nerve roots and, so as to prevent incapacitating deformity or pain due to structural changes (White Aa 3rd Fau - Johnson, Johnson Rm Fau - Panjabi, Panjabi Mm Fau - Southwick & Southwick).

The combined effect of the stabilization muscles is comparable to wearing a corset. An external corset can also support our spine but has the disadvantage that muscle activity is limited (Figure 72). It is not recommended as a substitute because it weakens the muscles. Good back stability can reduce load and avoid recurring complaints.

An independent risk factor for chronic LBP is the weakness and lack of motor control of deep trunk muscles, e.g. the lumbar multifidus (LM) and transversus abdominis (TrA) muscles (Huijbregts, 2005).

Wearing a corset or back belt provides support. The purpose of specific abdominal and back muscles is to create a natural corset.



Figure 72: A spinal corset

Contraction of the m. transversus abdominis muscles



Figure 73: Contraction of the stabilizing muscles

Contraction of the m. multifidus



Figure 74: Palpation of the musculus multifidus

7. Natural movements

7.1. Sitting down and standing up

The next transfers do not only apply to pathological patients, i.e. patients with specific pathologies; they also apply to every healthy person. They are ways to change the posture with the lowest possible load on the back.

We need to take these into account as much as possible when performing transfers.

Stand-to-sit

Stand as close to the chair as possible. Place one foot in front of the seat, and one foot just underneath it. You may place your hands on your knees. To sit down, bring your shoulders forward and your back backward. Do not place your hands behind your back on the chair. Sit down and do not drop down.

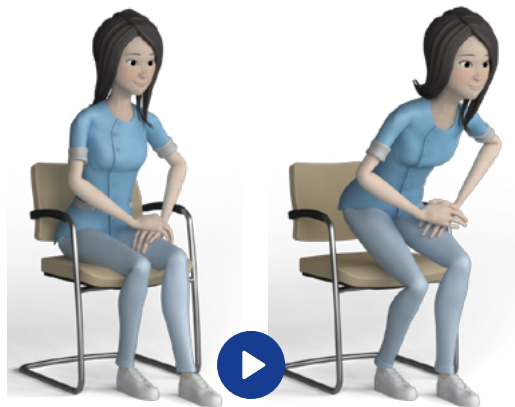


Figure 75: Sitting down

Strive for natural movements. Take this into account as much as possible when making transfers.

Sit-to-stand

Move one leg under the chair. Place both hands on one leg. Lean forward with the trunk and push up (Figure 76).

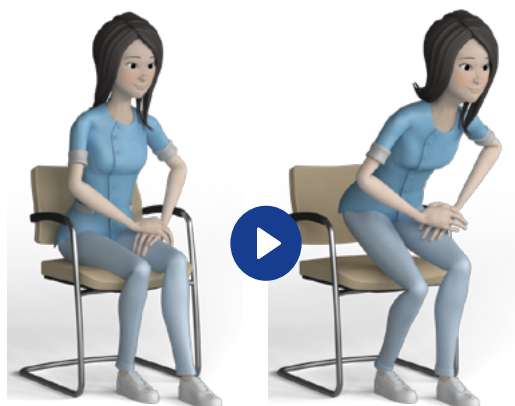


Figure 76: Standing up

7.2. Lying down

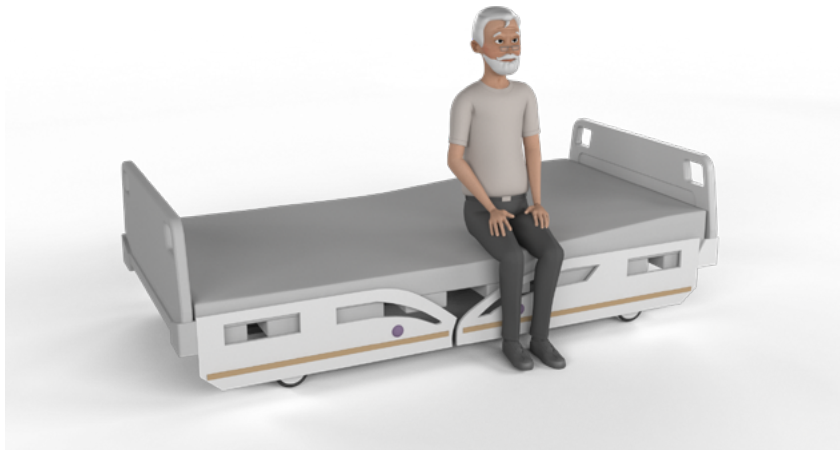
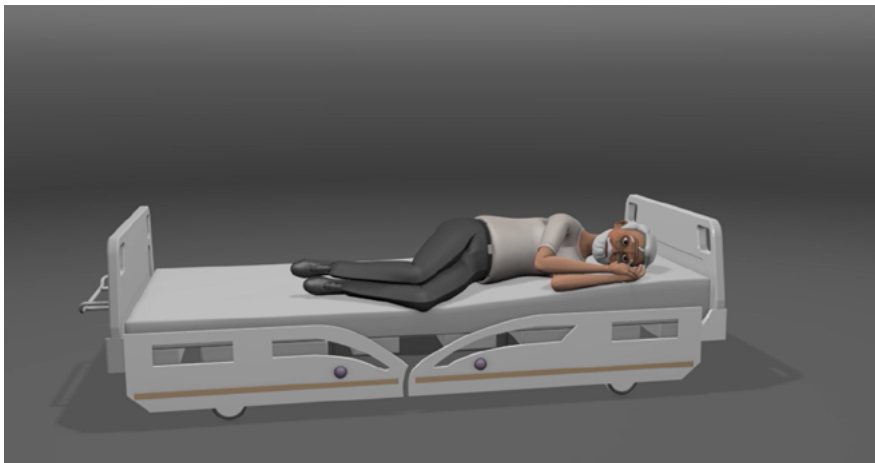


Figure 77: Sit-to-lie

Sit-to-lie (log roll)

Starting position: with the back towards the bed, which is positioned as low as possible (Figure 77).



Sit close to the pillow. Flex your hips and bend your knees: bring your torso forward. Sit as far on the bed as you can (if necessary, move further on the bed with a 'duck walk'). Put your hands on the bed on the side of the pillow.

Lie down on your side while at the same time bringing your legs in the bed.

Perform a log roll on your back, in one movement, i.e. turn your ankle, knee, hip, shoulder and head all at the same time.

8. Basic postures and movements

8.1. Bank posture

Reference: *Ruggensteun voor zorgverleners* ((Back support for caregivers, Tania Goderis, Marleen Vandewalle, Christophe Maes).

- Correct posture: respecting the physiological curvatures;
- Tighten your muscular corset;
- Place your feet at approximately double hip width, slightly turned outwards;
- Bend your knees and turn them slightly outwards. Your knees should be above the tip of your toes.
- At the same time, bend your torso slightly forward, flexing your hips, but respect the physiological curves (hip angle at 90 °);
- Bring your arms between your legs;
- Keep facing forward. This posture requires sufficient leg muscle strength.



Figure 78: Bank posture

8.2. Rappel

Reference: *Ruggensteun voor zorgverleners* (Tania Goderis, Marleen Vandewalle, Christophe Maes).

- Starting posture: bank posture;
- Respect the physiological curvatures and tighten your muscular corset;
- Let your body tilt backwards, like a counterweight;
- Do not hang from your lower back; instead move your buttocks backward. Keep your shoulders in front of your pelvis.



Figure 79: Rappel movement

8.3. Front-back weight shifting

Reference: *Ruggensteun voor zorgverleners* (Tania Goderis, Marleen Vandewalle, Christophe Maes).

Hereby, we describe the backward bending-stretching motion. In the forward bending-stretching motion, perform the movements in reverse order.

- Starting posture: feet at hip width.
- Your feet point forward. Place one foot forward, the other backward. Bend your front leg and stretch your back leg.
- Put your torso in line with your back leg and tighten your muscular corset. Make sure to preserve the physiological curvatures.



Figure 80: Front-back weight shifting

- To move backwards, stretch your front leg and bend your back leg. Your torso remains inclined.
- Move your body horizontally. Keep your pelvis at the same height throughout this motion; do not raise it. Picture yourself walking under a low ceiling. Do not rotate your body! The movement should only happen from your legs. Tip: imagine a chair behind you and wanting to sit down on it, except you do not.

8.4. Lateral weight shifting

- Starting posture: bank posture.
- Move your trunk sideways, parallel to your pelvis. Stretch one leg, bend the other leg even more.
- Your pelvis and your shoulder girdle remain horizontal, parallel to each other.
- Do not rotate or twist your back.



Figure 81: Lateral weight shifting

8.5. Pivot

Reference: *Ruggensteun voor zorgverleners* (Tania Goderis, Marleen Vandewalle, Christophe Maes).

- Starting posture: bank posture.
- Avoid torsional movement of the lower back. The combination of bending and twisting results in a drifting movement on the intervertebral disc, which puts a big load on the back.
- Because of this, when moving objects, we should perform a pivot movement by turning the entire body on the forefoot. The shoulders and the pelvis stay together in the same direction, thus avoiding a torsion in the back.



Figure 82: Pivot

8.6. Kneeling

Reference: *Ruggensteun voor zorgverleners* (Tania Goderis, Marleen Vandewalle, Christophe Maes).

- Starting posture: place one foot forward; feet at hip width.
- Respect the physiological curves; tighten your muscular corset. Keep your back straight, bend your legs until one knee touches the ground. Optionally, you can place one hand on your knee for assistance.



Figure 83: Kneeling

8.7. Golfer's movement

- Starting position: standing.

- Support your weight on one leg and swing the other leg backwards; slightly bend the supporting leg. The swing leg is in line with your back.
- The opposite hand rests on the upper leg of the supporting leg. If there is a chair or other object nearby, you can also use it for support. The hand on the same side of the supporting leg rests on the upper leg of the supporting leg. If there is a chair or other object nearby, you can also lean on that..



Figure 84: Golfer's movement

9. Care Tasks

Organizing mobility care tasks

Movement is the foundation of good health. As caregivers, we strive for mobility in healthcare, not only for ourselves but also for our care recipients. We aim to keep our care recipients as mobile as possible by creating awareness of how our bodies move, both for ourselves and for them.

When performing a transfer, it is important to know:

1. which transfer you are going to perform
We have identified 8 basic transfers and categorized them into 3 categories:
 - a. without aids (w/o)
 - b. with aids (a)
 - c. with aids for obese care recipients (o)
2. how you are going to perform the transfer
 - a. Some of the 3 categories will overlap in content, and you will see an equal animation
3. the capabilities of the care recipient, categorized into 5 mobility classes with 2 mobility tools
 - a. BMAT
 - b. MK5
4. (if applicable) the aids you are going to use
 - a. A good inventory and agreements regarding aids linked to a mobility class are essential.

This way, you can:

1. assess your workspace;
2. place your equipment/aids functionally;
3. explain to the care recipient which transfer you are going to perform and what you expect (if not possible, refer to the chapter on haptonomy).

Communication is crucial because we do not have control over the care recipient's body. It is vital that the care recipient fully cooperates, and therefore, the care recipient must understand what is expected of them. Work together with the care recipient, respecting the physiological curves of your own spine. A body in motion requires less energy to remain in motion. This strengthens both the care recipient and yourself in the situation.

Although we have studied the theory, in practice, we will encounter various situations that require a flexible approach. It is important to develop this practical experience and learn how to adapt theoretical concepts to the complex reality of the healthcare environment.

In practice, you will find that theoretical approaches to postures and movements cannot always be seamlessly applied. Various factors, such as the individual needs of the care recipient, the layout of the room, and the available transfer aids, will influence how you apply these concepts in practice.

It is essential to be flexible and learn to use variations of theoretical concepts to meet the unique needs of each situation.

A crucial aspect of performing transfers and mobility activities is awareness of your own body and the physiological curves of the spine. By respecting these and applying the correct techniques, we can minimize the strain on our bodies and reduce the risk of injury. Following practical tips and tricks will help us work more effectively and safely in various healthcare scenarios.

General Principles

Tips regarding your environment:

1. Organize the workspace ergonomically;
2. Ensure you have sufficient workspace;
3. Adjust and organize your workspace - think before you begin;
4. Estimate the weight;
5. Avoid lifting heavy objects;
6. Use transfer aids as necessary (especially from MK5-C onwards);
7. Keep the load as close to your body as possible;
8. Position the workstation at an appropriate height;
9. Adjust the speed at which you lift;
10. Work with two caregivers if possible.

Tips regarding yourself:

1. Maintain good physical condition;
2. Maintain the normal physiological curvature of your back. Keep your shoulders low, and your arms extended or in a strong open angle;
3. Stabilize your spine;
4. Maintain good balance and stability;
5. Use your body weight to move the load;
6. Never combine tilting and twisting;
7. Use your legs;
8. Always use supports;
9. Monitor your breathing;
10. Acknowledge your capabilities.

Assessment scales

When choosing the right aid or transfer technique, the mobility of the care recipient is particularly decisive. As the care recipient's mobility decreases, more assistance is required, increasing the risk of physical strain on the caregiver. We choose to work with two mobility classes, the Bedside Mobility Assessment Tool (BMAT) and the 5 Knibbe Mobility Classes (MK5).

MK5 (5 Mobility Classes Knibbe)

To provide practical guidance, LOCOmotion has developed a classification into five Mobility Classes (Knibbe et al., 1998). In this concept, care recipients are categorized into five levels based on their functional mobility (A, B, C, D, and E). This classification is not based on a medical diagnosis but on the limitations and abilities of the client to participate in activities such as transfers.

Watch a [video](#) explaining the MK5 here.

Mobility Class	Autonomy	Risk of Physical Overload	Active client	Encouraging mobility is desirable
 A	✓	✗	✓	✓
 B	✗	✗	✓	✓
 C	✗	✓	✓	✓
 D	✗	✓	✗	✓
 E	✗	✓	✗	✗

Table 3: Diagram Mobility Classes (Knibbe et al., 1998)

BMAT (Bedside Mobility Assessment Tool 2.0)

The BMAT is a tool developed to assess mobility in hospitalized care recipients. This mobility assessment can influence treatment, transfer techniques, and outcomes, including the risk of falls. Using a mobility assessment can provide reliable information to improve the safety of the care recipient and prevent complications resulting from immobility. A study of the BMAT provides initial evidence that it is a valid instrument for assessing the mobility of a care recipient at the bedside (The Bedside Mobility Assessment Tool 2.0: Advancing patient mobility. Teresa Boynton, MS, OTR, CSPHP, Dee Kumbar, BSN, RN, MBA; and Catherine VanGilder, MBA, BS, MT, CCRA).

BEDSIDE MOBILITY ASSESSMENT TOOL (BMAT 2.0) © 2020

Figure A (page 1 of 2) BMAT 2.0 to be completed at time of admission, at least once per shift and with any significant change in patient's status.

Test/Assessment Level	Description of Test	Pass Response	PASS =
Assessment Level 1 Assessment of: <ul style="list-style-type: none"> sitting balance upper extremity and core strength ability to sit upright without getting tachycardic, diaphoretic and/or light-headed; i.e., sitting tolerance 	Sit and Shake: From semi-reclined position or at EOB, ask patient to sit upright for up to 1 minute (if there is any concern regarding orthostatic hypotension or postural intolerance); then reach across midline and shake hands with caregiver – repeat with other hand. (Patient's feet may either be flat on floor or dangling.) Safe Mode: Use sling and lift to assist to side of bed (e.g., sternal precautions, abdominal incision) or bed in chair position, then complete "Sit and Shake."	Sit: Able to follow commands and sit unsupported (i.e., unsupported by sling or bed surface) for up to 1 minute. Shake: Able to maintain seated balance while challenged by reaching across midline of trunk with one or both hands and shaking caregiver's hand.	Pass Assessment Level 1 "Sit and Shake" = Proceed to Assessment Level 2, "Stretch" Fail = Mobility Level 1 Patient As appropriate, follow Critical Care Early/Progressive Mobility Program protocol to advance through BMAT Assessment Levels.
Assessment Level 2 Assessment of: <ul style="list-style-type: none"> leg strength in preparation for weight bearing control and strength of leg muscles, including quadriceps and lower leg muscles foot drop 	Stretch: While sitting upright unsupported, extend one leg and straighten knee (knee remains below hip level) and point toes/pump ankle between dorsiflexion/plantar flexion x 3 repetitions. (Patient's feet may either be flat on floor or dangling.) Safe Mode: Continue to use sling and lift (mobile or overhead/ceiling), bed in Fowler's or chair position to complete "Stretch."	Stretch: Able to extend leg and straighten knee = engage quadriceps; then able to pump ankle for 3 repetitions = AROM/move ankle between dorsiflexion/plantar flexion = engage calf muscles/skeletal muscle pump and assist with venous return/fluid shifts.	Pass Assessment Level 2 "Stretch" = Proceed to Assessment Level 3, "Stand" Fail = Mobility Level 2 Patient
Assessment Level 3 Assessment of: <ul style="list-style-type: none"> ability to shift forward, raise buttocks and rise smoothly; balance and strength to rise standing tolerance for up to 1 minute, which allows for fluid shifts and other compensatory changes to occur static standing balance 	Stand: With feet flat on floor about shoulder width apart, shift forward, raise buttocks/rise and stand upright for up to 1 minute (if there is any concern regarding orthostatic hypotension, postural intolerance or syncope). Safe Mode: Use sit-to-stand lift and vest/sling, or ambulation vest/pants and lift. Always default to using Safe Mode if concerned regarding orthostatic hypotension/syncopal event or other compensatory changes.	Stand: Able to rise, maintain balance and upright standing position for up to 1 minute. The majority of patients who exhibit orthostatic hypotension do so within the first minute of standing, which is the rationale for 1 minute. Use walker, cane, crutches or prosthetic leg(s) as appropriate to assist.	Pass Assessment Level 3 "Stand" = Proceed to Assessment Level 4, "Step" Fail = Mobility Level 3 Patient
Assessment Level 4 Assessment of: <ul style="list-style-type: none"> pre-ambulation weight shift abilities further assessment of leg strength dynamic standing balance, which further allows for fluid shifts and other compensatory changes to occur cognitive ability to follow directions 	Step: 1) March- or step-in-place taking small steps (not high-marching steps) x 3 repetitions; if able to pass then 2) Step forward with one foot, weight-bear/shift weight onto foot and return foot to starting position; repeat with other foot. Safe Mode: Use ambulation vest/pants and lift; consider use of bed in chair position and egress from end-of-bed. Always default to using Safe Mode if concerned regarding orthostatic hypotension/syncopal event, other compensatory changes or falls.	Step: Able to perform both marching-in-place and forward step and return with one foot and then the other. Use walker, cane, crutches or prosthetic leg(s) as appropriate.	Pass Assessment Level 4 "Step" = Progress through Discharge Planning Continue to complete BMAT per protocol; address medical issues and stability; use multidisciplinary approach; work on discharge goals for best destination/placement; consider functional status, ongoing equipment needs and ADL's Fail = Remain a Mobility Level 4 Patient

Figure A (page 2 of 2)

Patient's BMAT Mobility Level	Assessment Level				Test Options in SAFE MODE (See Figure A, page one for Description of Basic Test)	Patient Care and Strengthening in SAFE MODE SPHM Equipment to Consider for patient care/strengthening NOTE: Consult with PT/OT per facility protocol
	1. Sit & Shake*	2. Stretch*	3. Stand*	4. Step*		
Mobility Level 1 = Fails/unable to "Sit and Shake" As appropriate, follow Critical Care Early/Progressive Mobility Program protocol.	FAIL	NA	NA	NA	1) Perform with patient sitting upright in bed 2) Using lift and sling help patient sit at Edge of Bed (EOB) As appropriate, follow Critical Care Early/Progressive Mobility Program protocol to advance through BMAT Assessment Levels.	Goals: Avoid complications of immobility, engage and strengthen postural muscles and progress to Level 2. 1) Edge of Bed (EOB) dangling with sling and lift: work on sitting balance and reaching across midline; perform calf pump exercises 2) Bed in Fowler's or chair position: sitting supported or unsupported to cross midline and shake hands; also perform calf pump exercises 3) Lift and repo sheet: for boosting and turning 4) Lift and multistraps: for turning and limb holding 5) Lift and sling: for bed to chair/commode transfer 6) Friction Reducing Device (FRD): for PROM/AROM exercises
Mobility Level 2 = Passes "Sit and Shake," Fails/unable to "Stretch"	PASS	FAIL	NA	NA	1) Perform with patient sitting upright in chair position 2) While at EOB dangling and secured by sling and lift	Goals: Avoid complications of immobility, engage and strengthen postural and lower extremity muscles, assist with fluid shifts and progress to Level 3. 1) FRD: partial squats and leg AROM exercises – bed flat or tilt position 2) Lift and repo sheet: boosting and turning 3) Lift and multistraps: limb holding or turning 4) Lift and sling: bed to chair/toilet transfer 5) In bed: perform additional calf pump exercises
Mobility Level 3 = Passes "Sit and Shake," and "Stretch," Fails/unable to "Stand"	PASS	PASS	FAIL	NA	1) Using sit-to-stand lift with vest: evaluate patient's tolerance for standing upright and weight bearing; monitor patient's BP and HR; maintain balance for up to 1 minute. 2) Using standing/ambulation vest or pants and floor-based or ceiling lift: starting with patient's feet flat on floor, instruct patient to rise and stand; monitor patient's BP, HR, standing balance and tolerance for up to 1 minute. As appropriate, after testing in Safe Mode, use walker, cane, crutches, prosthetic leg(s) to evaluate standing tolerance and to progress to "Step."	Goals: Strengthen muscles in upright position, assist fluid shifts, avoid falls and progress to Level 4. 1) Sit-to-stand lift with vest/sling: stand for 1-2 minutes; shift weight from one foot/leg to the other, 2-3 deep breaths 2) Squats using FRD with bed in tilt position 3) Lift and multistraps: limb holding 4) Powered or non-powered sit-to-stand lift for bed to chair/toilet transfers (e.g., quick night-time transfer to and from toilet) 5) If using aid (walker, cane, crutches, prosthetic), after standing with sit-to-stand lift, work on standing with aid.
Mobility Level 4 = Passes "Sit and Shake," "Stretch" and "Stand," Fails/unable to "Step"	PASS	PASS	PASS	FAIL	1) If a sit-to-stand lift with vest was used and patient passed "Stand," evaluate first portion of "Step," march-in-place, while patient is still secure in vest attached to sit-to-stand lift. 2) Using ambulation vest or pants attached to lift: evaluate "Step" by instructing patient to march-in-place. If able to perform march-in-place, instruct patient to advance step with one foot and return foot to starting position. If able to pass, repeat with other foot. Use walker, cane, crutches or prosthetic leg(s) as appropriate.	Goals: Improve standing tolerance and endurance with stepping and weight-shifts, balance and ambulation; avoid falls; consider mobility, functional status, and discharge goals. 1) Lift and ambulation vest/pants for standing, stepping-in-place, weight-shifting/balance activities, and walking 2) Set distance goals to improve endurance and confidence with lift and without lift after passing "Step." 3) If using aid (walker, cane, crutches, prosthetic) to pass "Step," assure that aid is always easily accessible and used for transfers in-room and during hallway ambulation.
Progress through Discharge Planning = Passes all 4 Assessments Review Discharge Goals; Post-acute Discharge Planning	PASS	PASS	PASS	PASS	<ul style="list-style-type: none"> Continue to complete BMAT per protocol; with any change in status adjust Mobility Level and goals as needed. While improving/maintaining mobility, continue to address medical issues and stability as needed; evaluate other medical conditions/treatment plan prior to physician release. Mobility goals may include: independence with bed mobility and transfers; improve balance, standing tolerance, endurance with walking; independence with aid(s) - walker, cane, crutches, prosthetic(s). Multidisciplinary approach: <ul style="list-style-type: none"> Compare pre-admit status, including ability to perform ADLs, to discharge status; i.e., previous level of function (PLOF) compared to post-acute functional status; review rehabilitation goals – have they been met? Review discharge goals and guide discharge recommendations; appropriate post-acute discharge destination and equipment needs. 	









NOTE: Always default to the safest testing/lifting/transfer method (e.g., total lift and sling) if there is any doubt in the patient's ability to perform the task.

Source: https://www.myamericannurse.com/wp-content/uploads/2020/07/fig-A-210673-EN-r2_BMAT-2.0-Stair-Step-Chart_Presentation-LR2-Copy-1-2.pdf

Table 4: Comparison between BMAT and MK5

Level 4+	Class A
<ul style="list-style-type: none"> • Independence • No assistance needed for walking, but may use an aid, as a cane or crutches. • The patient demonstrates a stable gait and good balance while marching and stepping forward and backward. The patient can make necessary turns for mobility in the room. The patient shows awareness of safety. 	<ul style="list-style-type: none"> • The patient is virtually independent and may walk with a cane or walker. • The patient is self-sufficient and can perform self-care and dressing. • Maintaining mobility is important for both the client and the caregiver. • No risk of physical overload for caregiver.
Level 4	Class B
<ul style="list-style-type: none"> • The patient exhibits stability and strength in both upper and lower limbs and bears weight for at least one minute, but cannot march. It is possible to test weight-bearing on just one leg and proceed accordingly (e.g., in a stroke patient, patient with a cast on one ankle). A mobility aid is generally needed (cane, walker, crutches). 	<ul style="list-style-type: none"> • The patient is relatively independent in mobility but unable to perform transfers and ADL activities independently and relies on a caregiver for this. • The patient uses a walker or similar assistive device. • Maintaining mobility is important for both client and caregiver. • No risk of physical overload for caregiver.
Level 3	Class C
<ul style="list-style-type: none"> • The patient exhibits stability, strength, and control in the lower limbs (can stretch and flex leg and ankle), but cannot bear weight.. It is possible to test just one leg and proceed accordingly (e.g., in a stroke patient, patient with a cast on one ankle). 	<ul style="list-style-type: none"> • The patient is moderately active in mobility and unable to perform transfers and ADL activities independently, relying on a caregiver for assistance. • The patient is (mostly) wheelchair-bound and unable to stand independently. • Physical strain for the caregiver is physically demanding. The use of aids that partially or fully take over the actions is necessary. • It is important for both the patient and the caregiver to encourage remaining abilities and slow down the decline in mobility.
Level 2	Class D
<ul style="list-style-type: none"> • Patient can follow commands • Has some trunk strength • Patient is able to maintain balance in a sitting position for more than one minute (without caregiver assistance). Shake: Patient has significant upper body strength, spatial awareness, and grip strength. 	<ul style="list-style-type: none"> • The patient is relatively passive in mobility and unable to perform transfers and ADL activities independently. • The patient is wheelchair-bound and unable to support themselves. • The patient cannot stand without assistance and is fully dependent on a caregiver. • Physical strain for the caregiver is physically demanding. The use of aids that partially or fully take over the actions is necessary. • Maintaining bodily functions is important for both the patient and the caregiver. Preventing complications of immobility (such as pressure ulcers) is an additional focus.
Level 1	Class E
<p>Unable to perform 'Sit and shake'</p> <p>Sit:</p> <ul style="list-style-type: none"> • Lacks trunk strength • Unable to maintain balance in a sitting position for one minute (without caregiver assistance) <p>Shake:</p> <ul style="list-style-type: none"> • Patient lacks significant upper body strength • Lacks spatial awareness • Lacks grip strength 	<ul style="list-style-type: none"> • The patient is passive and unable to perform transfers and ADL activities independently. • The patient is entirely dependent on a caregiver. Physical strain for the caregiver is physically too demanding. • The patient may be completely bedridden and often prone to stiffness and contractures. • Providing optimal care and preventing or limiting the complications of immobility, such as pressure ulcers, are at the forefront.

Table 5: Overview of available animations.

	BMAT	1			2			3			4			4+		
 Higher in seating position (in wheel) chair)		E			D			C			B			A		
	MK5	w/o	a	o	w/o	a	o	w/o	a	o	w/o	a	o	w/o	a	o
 From sit to stand	BMAT	1			2/3						4			4+		
	MK5	E			D			C			B			A		
 From sit (EOB) to sit	BMAT	1			2			3/4						4+		
	MK5	E			D			C			B			A		
 From sitting(EOB) to lying	BMAT	1						2			3			4/4+		
	MK5	E			D			C			B			A		
 Rolling from back to side lying	BMAT	1						2			3			4/4+		
	MK5	w/o	a	o	w/o	a	o	w/o	a	o	w/o	a	o	w/o	a	o
 Higher in bed	BMAT	1			2			3			4			4+		
	MK5	E			D			C			B			A		
 From stand to sit	BMAT	1			2/3						4			4+		
	MK5	E			D			C			B			A		
 From lying to sitting (EOB)	BMAT	1									2/3			4/4+		
	MK5	E			D			C			B			A		

Abbreviations: (w/o) without aids; (a) with aids; (o) with aids for obese care recipients

General considerations

- Check for any restrictions with each manipulation.
- Always use a haptic approach.
- Respect spontaneous movements each time.
For example, when assisting with sitting up (apple), keep the aid (e.g., riser, walker) nearby. When assisting with leaning forward (pear), place the aid slightly further away to allow for strong forward bending.
- Encourage the care recipient to cooperate to the fullest extent possible.
- Apply the basic principles as much as possible
- Use appropriate aids as needed.
 - Pay attention to the maximum allowable weight of the aid.
 - The choice of aid depends largely on the weight of the care recipient and the type of chair.
- Discourage movements without aids from MK5-C onwards or BMAT-3 and previous levels.
- Give extra attention to safety.

Higher in seating position (in (wheel)chair)		
BMAT-1	MK5-E	
	AIDS	Focus points
Without aids Old higher wheelchair level2	Strongly recommended with aids <ul style="list-style-type: none"> • Sliding sheet • Sliding board • (ceiling)hoist 	Strongly discouraged without aids Make use of patient's residual capacity Push on bony structure At the same time, shift your weight
With aids 02_Hogere_In_Stoel+Glijlaken_jacob	Sliding sheet If necessary, use the inclination of the chair to facilitate backwards movement. Use passive (ceiling) hoist if necessary	Use weight shift Applying a sliding sheet with unwinding technique. Bring body forward with rolling movement. Push on knee or pelvic crest
Person with obesity 06. Optillen met passieve tillift From sec25	Use an adapted passive hoist XL or ceiling hoist	If possible, tilt the chair to facilitate movement. Lift the patient with a lifting aid and place it backwards in the seat.

Higher in seating position (in (wheel)chair)		
BMAT-2	MK5-D	
	AIDS	Focus points
oud - hoger in Rolstoelniveau2	Strongly recommended with aids <ul style="list-style-type: none"> • Sliding sheet • Sliding board • (ceiling)hoist 	Movement without aids strongly discouraged Leverage the care recipient's remaining capacity Push on bony structures Shift your weight simultaneously

With aids 02_Hogere_In_Steel+Glijlaken_jacob	Sliding sheet or sliding board	Leverage the care recipient's remaining capacity Respect your natural curves when placing the aid. Utilize weight shifting Push on the care recipient's knee
Person with obesity 02_Hogere_In_Steel+Glijlaken_jacob	Use a sliding sheet If possible use an adapted (ceiling) hoist XL	Lift the care recipient with the lifting aid and place them backwards into the seat.

Higher in seating position (in (wheel)chair)		
BMAT-3		MK5-C
	AIDS	Focus points
Without aids oud - hoger in rolstoelniveau3	Strongly recommended to use aids: sliding sheet, sit to stand assistive device or active hoist.	Not recommended without aids. Ask the care recipient to lean forward and to the side. If one is relieved from pressure, push on the knee or hip crest.
With aids 02_Hogere_In_Steel+Glijlaken_jacob	Sliding sheet This can also be done with a sit-to-stand assistive device or active lift	Utilize the remaining capacity of the care recipient. Respect your natural curvatures when placing the aid. Use weight shifting. Push on the knee of the care recipient.
Person with obesity 02_Hogere_In_Steel+Glijlaken_jacob	Sliding sheet This can also be done with a sit-to-stand assistive device or active lift	Utilize the remaining capacity of the care recipient. Respect your natural curvatures when placing the aid. Use weight shifting. Push on the knee of the care recipient.

Higher in seating position (in (wheel)chair)		
BMAT-4		MK5-B
	AIDS	Focus points
Without aids oud - hoger in Rolstoelniveau 4		Guide the spontaneous movement Use a buttock march or rocking motion (leaning forward and pushing back on the arms)
With aids	Not applicable	
Person with obesity oud - hoger in rolstoelniveau 4	Sliding sheet, adjusted walker or rollator	A slide sheet under one buttock can facilitate the movement.

Higher in seating position (in (wheel)chair)



BMAT-4+		MK5-A
	AIDS	Focus points
Without aids oud - hoger in Rolstoelniveau 4		Stimulate spontaneous movement by verbal guidance
With aids	Not applicable	
Person with obesity oud - hoger in rolstoelniveau 4		Stimulate spontaneous movement by verbal guidance

From sit to stand



BMAT-3 with aids		MK5-C
	AIDS	Focus points
Without aids oud - zit-sta niveau 2-3	An active lift or standing aid is recommended.	Avoid without aids. Move the feet sufficiently backward. Lean the torso forward. Encourage spontaneous movement. Never let yourself be held by the neck.
With aids 01_Zit naar zit_C_jacob (tot sec32)	Active lift or standing aid	Use the appropriate aid. Encourage the care recipient to the maximum.
Person with obesity 01_Zit naar zit_C_jacob	Active lift or standing aid. Check if the aid can support the weight	Use the appropriate aid. Encourage the care recipient to the maximum.

From sit to stand



BMAT4		MK5B
	AIDS	Focus points
Without aids (recommended) 07_zit naar stand_B_jacob		Do not impede spontaneous movement. Ensure the weight of the care recipient remains above the feet. Encourage standing upright.
With aids	Rollator, cane	Position the walking aid so as not to obstruct spontaneous movement. Maximize encouragement for the care recipient.
Person with obesity 14_Zit naar sta_Peer_Yolanda 03 Sit to stand apple Jerry	Adjusted rollator or walker	Do not impede spontaneous movement. Place the aid close by when feasible. Position the aid further (to allow for strong forward bending) when necessary.

From sit to stand		
BMAT4 +		MK5A
	AIDS	Focus points
Without aids oud - zit-sta niveau 4	Not applicable	Stimulate spontaneous movement by verbal guidance
With aids	Not applicable	Not applicable
Person with obesity 03 Sit to stand apple Jerry	Adjusted (wheel)chair	Stimulate spontaneous movement by verbal guidance



From sit (EOB) to sit		
BMAT3/4		MK5C
	AIDS	Focus points
Without aids (strongly recommended) Old Sit to Sit level 2	Active lift or standing aid is recommended	Not recommended without aids Moving without standing up Placing feet backward Bringing upper body forward Do not obstruct spontaneous movement Assistant can guide pelvis along the direction of movement
Without aids 01 Zit naar zit_C_jacob	Active lift or standing aid	Use your own body weight to initiate movement of the lifting aid.
Person with obesity 01 Zit naar zit_C_jacob	Adjusted aid	Use your own body weight to initiate movement of the lifting aid.



From sit to sit		
BMAT4		MK5B
	AIDS	Focus points
Without aids old - zit-zit niveau 3		Do not impede spontaneous movement. Prefer support on walking aid.
With aids	Rollator, cane, walker, rollator	Secure the care recipient when making the turning movement - anticipate with the aid.
Person with obesity 03 Zit en sta Apple_Jerry	Adjusted rollator, cane, walker, rollator	Guide the care recipient considering the spontaneous movement (apple and pear).



From sit to sit



BMAT4 +		MK5A
	AIDS	Focus points
Without aids old- zit-zit niveau 4		Guide (verbally) the care recipient if needed.
With aids	Not applicable	
Person with obesity 03_Zit en sta Apple_Jerry		Guide the care recipient considering the spontaneous movement (apple and pear).

From sitting (EOB) to lying



BMAT-3		MK5-C
	AIDS	Focus points
Without aids (recommended) oud - zit-lig niveau 2	Recommend to use aids: Bed, grab rail, half bed rail	Not recommended without aid Maximize the patient's capabilities Ensure the patient is sitting deep enough in bed Provide the patient with a sense of safety Guide the patient's legs into bed
With aids	Bed, grab rail, half bed rail	Use the head of bed of the bed to assist the patient in lying down Place a hand on the half bed rail for extra support while lying down
Person with obesity	See FAQ	Ensure the patient begins with ground contact Use the bed as an aid (head of bed) Guide legs into bed one at a time

From sitting (EOB) to lying



BMAT-4		MK5B
	AIDS	Focus points
Without aids (recommended) oud - zit-lig niveau 3-4		First the upper body, followed immediately by the legs (if necessary, guide the legs). When straightening up, lower the legs first and then the upper body.
With aids	Pull-up bar	Using a pull-up bar can help slow down sideways or backward lying down. Use the head of bed as much as possible to guide the patient when lying down.
Person with obesity	see FAQ	The pull-up bar is a welcome aid. Bring the legs into bed one by one.

From sitting (EOB) to lying



BMAT-4 +		MK5-A
	AIDS	Focus points
Without aids (recommended) oud - zit-lig niveau 3-4		Lay down the upper body and bring the legs into bed at the same time. Then, turn onto the side.
With aids		
Person with obesity	See FAQ	

Turning from the back to the side



BMAT-1		MK5-E
	AIDS	Focus points
Without aids oud - terug naar zij niveau 1-2-3	Recommended to use aids: sliding sheet, draw sheet or double sheet	Not recommended without aid Don't forget to raise the bed rails. Respect spontaneous movement Place one leg over the other or fold one leg to serve as a lever Use a (draw) sheet to tilt the care recipient towards you Use your own body weight for this purpose
With aids 09_Back-to-side-roll-obese-Jolanda	sliding sheet, draw sheet or double sheet	Make sure that the shoulder and pelvic belt are included Place sliding sheet on the turning side Turn/rotate in place using a sliding sheet or sliding sheet
Person with obesity 09_Back-to-side-roll-obese-Jolanda	Adjusted aids: sliding sheets, turning sheets/ bands in combination with (ceiling) lift	Work with 2 coordinated helpers Make clear arrangements: 1 helper pushes, the other holds the (draw) sheet

Turning from the back to the side





		MK5-D
	AIDS	Focus points
Without aids (recommended) 08_back_to-side-roll-jacob	Recommended to use aids: sliding sheet, draw sheet or double sheet	Not recommended without aid Don't forget to raise the bed rails Respect spontaneous movement Encourage the care recipient, no matter how little, to cooperate. Have them place one leg over the other or fold one leg to serve as a lever. Optionally, have the care recipient reach towards the side to be reached. Use a (draw) sheet to tilt the care recipient towards you

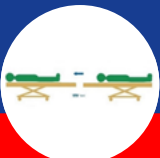
<p>With aids</p> <p>09_Back-to-side-roll-obese-Jolanda</p>	<p>sliding sheet, draw sheet or double sheet</p>	<p>Same as with obese patient</p> <p>This can be done with one caregiver if needed.</p> <p>Have the care recipient place one leg over the other or fold one leg (to serve as a lever).</p> <p>Encourage the care recipient to reach towards the side to be reached.</p> <p>Use a (draw) sheet to tilt the care recipient towards you – use your own body weight for this</p> <p>Use a slide sheet to rotate the care recipient in place</p>
<p>Person with obesity</p> <p>09_Back-to-side-roll-obese-Jolanda</p>	<p>Adjusted aids: sliding sheets, turning sheets/ bands in combination with (ceiling) lift</p>	<p>Place a pillow under the care recipient's legs – not on the turning side</p> <p>Work with 2 coordinated helpers (clear arrangements)</p> <p>Push and pull gently (1-2-3)</p> <p>1 helper pushes, the other holds onto the (draw) sheet at the level of the hip and shoulder belt</p> <p>Use a slide sheet to rotate the care recipient in place</p> <p>Ask for maximum cooperation from the care recipient</p>

Turning from the back to the side		
BMAT-3	MK5-C	
	AIDS	Focus points
<p>Without aids</p> <p>oud – rug naar zij niveau 4</p>	<p>Recommended to use aids: Sliding sheet</p>	<p>Not recommended without aid</p> <p>Raise the bed rails</p> <p>Physical or verbal guidance is sufficient</p>
<p>With aids</p> <p>oud - rug naar zijniveau 4</p>	<p>Sliding sheet</p>	<p>Place a slide sheet under the pelvis to facilitate turning and reduce frictional resistance.</p> <p>Caution! Remove slide sheet when getting out of bed</p> <p>If this is difficult for the care recipient, refer to BMAT2/MK5D</p>
<p>Person with obesity</p> <p>09_Back-to-side-roll-obese-Jolanda</p>	<p>Adjusted sliding sheet</p>	<p>Place a pillow under the care recipient's legs – not on the turning side</p> <p>Work with 2 coordinated helpers (clear communication)</p> <p>Push and pull gently (1-2-3)</p> <p>1 helper pushes, the other holds onto the (draw) sheet at the level of the hip and shoulder belt</p> <p>Use a slide sheet to rotate the care recipient in place</p> <p>Ask for maximum cooperation from the care recipient</p>



Turning from the back to the side		
BMAT-4		MK5-B
	AIDS	Focus points
Without aids oud - terug naar zijniveau 4		Under light guidance, the care recipient can turn themselves. Allow the care recipient to reach for the bed rail to be turned and have them place one leg over the other or push on one leg.
With aids	Sliding sheet	A slide sheet under the pelvis facilitates turning and reduces frictional resistance. Caution! Remove the slide sheet when getting out of bed.
Person with obesity oud - terug naar zijniveau 4	Adjusted sliding sheet	A slide sheet under the pelvis facilitates turning and reduces frictional resistance. Caution! Remove the slide sheet when getting out of bed.

Turning from the back to the side		
BMAT-4+		MK5-A
	AIDS	Focus points
Without aids oud - terug naar zijniveau 4		The care recipient does this independently, possibly with verbal guidance.
With aids	Not applicable	
Person with obesity oud - terug naar zijniveau 4		The care recipient can do this without aids

Higher in bed		
BMAT-1		MK5-E
	AIDS	Focus points
Without aids (recommended) oud - hoger op bedniveau 1	Sliding sheet Anti-slip mat (strongly recommended)	Strongly discouraged without aids Respect your physiological positions Coordinate the movement - count! Use Trendelenburg position/legs bent if possible
With aids oud hoger in bed level2	Sliding sheet Anti-slip mat	Place the sliding sheet under the pelvis and above the shoulders in the right direction Put the bed in Trendelenburg position (or elevate the legs) Bend the legs if possible and secure the feet (pillow under the forefoot) Can be done by 1 caregiver (with a light patient) Use your own body weight (move in the direction of the force)
Person with obesity 04_Hoger in bed_obesitas_Jerry	Adjusted sliding sheets and anti-slip mat Possible with (ceiling) lift	Place the sliding sheet under the pelvis and above the shoulders in the right direction Put the bed in Trendelenburg position (or elevate the legs) Bend the legs if possible and secure the feet (pillow under the forefoot) Two caregivers = work coordinatedly Use your own body weight (move in the direction of the force)

Higher in bed		
BMAT-2	MK5-D	
	AIDS	Focus points
Without aids (recommended) oud - hoger op bedniveau1	Sliding sheet Anti-slip mat (Recommended)	Without aids strongly discouraged Respect physiological positions Coordinate the movement - count!
With aids oud hoger in bed level2	Sliding sheet Anti-slip mat	Place sliding sheet under the pelvis and above the shoulders in the right direction Put the bed in Trendelenburg (or raise the legs) Fold the legs if possible and secure the feet (pillow under the forefoot) Can be done by one caregiver (for light patients) Use your own body weight (move in the direction of the force)
Person with obesity 04_Hoger in bed_obesitas_ Jerry	Adjusted slidingsheet and anti-slip mat Possible with (ceiling) lift	Place the sliding sheet in the right direction using the unrolling technique Work in coordination and make clear agreements (with colleague and patient) Use the bed as a tool: Trendelenburg or raise the legs (preferably semi-Fowler position - flat head of bed) Fold the legs if possible and secure the feet (pillow under the forefoot) Use your own body weight (move in the direction of the force)

Higher in bed		
BMAT-3	MK5-C	
	AIDS	Focus points
Without aids (recommended) oud - hoger op bedniveau 3	Strongly recommended to use aids: Sliding sheet Grab bar	Without aids not recommended Let the care recipient bend their legs The care recipient pushes on their feet to raise themselves higher Fix ankles / support under forefoot (e.g., pillow) / non-slip mat under heels Be careful not to push on the forefoot
With aids	Sliding sheet Grab bar	The grab rail can be used so that the care recipient can lift themselves up better and then push on their feet. The caregiver guides the care recipient in this process
Person with obesity 05 Higher In Bed+Gliding Sheet JERRY V2	Adjusted Sliding sheet and grab bar	Place sliding sheet with rolling technique A non-slip mat under the feet Let the care recipient cooperate to the maximum The headboard can then be used to pull oneself up The bed in slight Trendelenburg position can facilitate the movement

Higher in bed		
BMAT-4		MK5-B
	AIDS	Focus points
Without aids (recommended) oud - hoger op bedniveau 4		<p>Allow the care recipient to lift their legs</p> <p>The care recipient pushes on their feet to raise themselves higher</p> <p>Fixate ankles / support under the forefoot (e.g., pillow) / non-slip mat under heels</p> <p>Be careful not to push on the forefoot</p>
With aids	Sliding sheet Pull-up bar	The grab rail can be used so that the care recipient can lift themselves up better and then push on their feet. The caregiver guides the care recipient in this process
Person with obesity oud - hoger op bedniveau 4	Adjusted aids: Sliding sheet Pull-up bar	<p>Place sliding sheet with rolling technique</p> <p>If the care recipient has sufficient strength, they can be guided in the spontaneous movement upwards in bed.</p> <p>The headboard can then be used to pull oneself up</p> <p>A non-slip mat under the feet helps the care recipient to push off better</p> <p>The bed in slight Trendelenburg position can facilitate the movement</p> <p>Alternating from one side to the other when sliding upwards reduces friction and facilitates movement.</p>

Higher in bed		
BMAT-4+		MK5-A
	AIDS	Focus points
Without aids oud - hoger op bedniveau 4		The caregiver can assist the care recipient in the spontaneous movement.
With aids	Not applicable	
Person with obesity oud - hoger op bedniveau 4	Adjusted grab rail	<p>Assistance includes:</p> <p>Placing an anti-slip mat under the feet</p> <p>Adjusting the bed to a slight Trendelenburg position</p> <p>Alternating tilting from one side to the other (facilitates movement and reduces friction).</p>

From stand to sit		
BMAT-3 WITH AIDS		MK5-C
	AIDS	Focus points
Without aids (recommended) oud_Stand to sit niveau 2-3	If no aids are available, support from a rollator, walker, chair, bed edge, or table can provide some assistance for the care recipient. Ensure these supports are stable enough.	Without aids, it's not recommended. Encourage spontaneous movement. Push on the hips and stabilize the knees.
With aids 01_Zit naar zit_C_jacob (vanaf sec 46 tot einde)	Standing aid of active lift	An assistive device like a standing aid can be used here
Person with obesity 01_Zit naar zit_C_jacob (van sec 46 tot einde)	Adjusted standing aid or active lift	An assistive device like a standing aid can be used here

From stand to sit		
BMAT-4		MK5-B
	AIDS	Focus points
Without aids (recommended) oud_Stand to sit niveau niveau 4		Guide the care recipient verbally. Encourage spontaneous movement.
With aids	Walker, rollator	
Person with obesity 03_Zit en sta Apple_JErry	Adjusted standing aid	The care recipient can support themselves on their thighs to facilitate the movement.

From stand to sit		
BMAT-4+		MK5-A
	AIDS	Focus points
Without aids oud_Stand to sit niveau niveau 4		Encourage spontaneous movement.
With aids	Not applicable	
Person with obesity 03_Zit en sta Apple_JErry		Encourage spontaneous movement according to the apple or pear type

From lying to sitting (EOB)



BMAT-3		MK5-C
	AIDS	Focus points
Without aids (recommended) oud - lig naar zit niveau 2	A height adjustable with a liftable head of bed , bed is also an aid.	Using aids is strongly advised. Position the bed at the right height. Turn towards the patient's strongest side.
With aids 11a_lay-to-sit_obesse_B_jerry	A height adjustable with a liftable head of bed , bed is also an aid. Pull-up bar	Raise the patient sufficiently high in bed. Lower the bed to the appropriate level. Raise the head of the bed. Place the pull-up bar. Encourage the patient to move their legs out of bed. Rotate to the edge of the bed. Encourage maximum assistance from the patient.
Person with obesity 11b_lay-to_sit_obessereference_discs5	Adjusted turning disc, height adjustable bed and pull-up bar	Place a turning disc under the coccyx. Raise the head of the bed. Rotate in bed using the turning disc. Guide the patient gently.

From lying to sitting (EOB)



BMAT-4		MK5-B
	AIDS	Focus points
Without aids (recommended) Old Lie to sit level 3-4		The patient performs this independently with possible verbal guidance. Bed height should be low so the patient can get out of bed independently.
With aids	Use the bed as aid	A half bed rail can also be a tool for turning and getting up in bed.
Person with obesity 11a_lig-om-sit_obesse_B_jerry	Bed, turning disc	Ensure the patient is sufficiently high in bed. Lower the bed to an appropriate level. Raise the head of the bed. Place the pull-up bar. Encourage the patient to move their legs out of bed. Rotate to the edge of the bed. Encourage maximum assistance from the patient.

From lying to sitting (EOB)



BMAT-4+

MK5-A

	AIDS	Focus points
Without aids (recommended) Old Lie to sit level 3-4		The patient performs this independently with possible verbal guidance. Bed height should be low so the patient can get out of bed independently.
With aids	Not applicable	
Person with obesity Old Lie to sit level 3-4	Adjusted sliding sheet or turning disc	A sliding sheet or specialized turning disc placed under one buttock can facilitate turning in place.

10. How to use haptonomy for ergonomics in health care?

📖 Knibbe, H. & Knibbe, N.

A special way of properly performing transfers, the proper use of (lifting) aids, and the ergonomic performance of other caring actions arises from haptonomy. Haptonomy originally comes from physiotherapy and literally means 'the teaching of feeling' or touching affectively (Elbers and Duyndam, 2018). When acting 'haptonomically', you try to feel and touch the client in such a way that he or she can move as much as possible. This means that the use of the principles from haptonomy runs perfectly parallel to the stimulation of self-reliance. If you forcefully touch someone, with a firm, almost squeezing hand, this can lead to resistance on the part of the client, he or she can work against you. However, if you touch someone invitingly, with an open, soft hand, the client is stimulated to move himself. You guide the client, with a soft hand, in the desired direction, via the desired movement.

Signals

In terms of haptonomy, our body is not an isolated device that we use. No, we are our body (Merleau-Ponty, 2009). This also means that many messages go back and forth between the care provider and the client, often unnoticed. Signals often go through the skin, the sense of touch. The skin, the organ with which we feel (touch), is the greatest system of sense that lets us communicate and interact through touch. Think for example of the handshake you get when you meet someone. Of his facial expression. This already says everything about the client's condition, but also about how much distance the client wants to keep from you.

But those signals don't just go through the skin. The eyes often speak volumes. You can quickly see whether someone is alert, angry, confused, etc. And this is also mutual. The client quickly feels or sees your (un)rest, understanding or irritation. Before you know it, you are together in an upward or downward spiral based on non-verbal cues. In everyday speech, we often say that someone, including you, 'radiates' something. There is 'something hanging around him'. And sensing and responding to those non-verbal cues is exactly what haptonomy is all about. Some caregivers do this naturally, others have to learn it. This can be done with a lot of practice.

Space

Playing with space is one of the most important haptonomical principles we can use when activating clients. For example, if you leave little space between you and the client when getting up, the client will not be encouraged to get up on their own. Because in fact you indicate non-verbally that you think that the client cannot (largely) make the standing movement himself and that you take over the movement. Give it a try. The reverse is also true, if you are quite far away from the client, you will not be able to direct the client sufficiently and he will not get up. So, there is an optimal distance somewhere that gives the client a sense of security, but also radiates sufficient confidence that the client can largely do the transfer himself.

Caring in a haptonomical way is therefore a bit like dancing (Mol, 2005). If the two dance partners are far from each other, it will not look harmonious. That is also the case when they dance very close to each other. That optimum is somewhere. And that differs per care provider and per client. What one person experiences as close, the other does not have to experience as such. That is not only in healthcare, also in daily life you see some people standing very close to each other at parties, while others prefer to keep their distance.



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You cannot indicate this almost magical space in centimetres. You will have to feel that. The first contact with the client is crucial. Make time for that consciously. Have a chat, make eye contact, say the client's name or put your hand on the client's shoulder and wait for his or her response. Take it easy. The time you 'lose' with this first contact, you will gain it back amply later on.

Grip

The haptonomical thinking is also reflected in the way in which the care provider grips the client. If you touch his hand, arm or leg in a grasping, gripping way, you encompass a large part of that body part, it can trigger a fear response. This rarely happens with an open, non-catchy touch. So don't grasp unnecessarily. Keep your thumb next to your fingers. However, it is possible that the client has so little muscle strength that his arm or leg falls out of your hands. Only then is it really necessary to use the gripping function of your hand.

In addition, there are so-called 'power spots' (Mol, 2011). If you touch them, they can evoke a feeling of being dominated in the client. Although the exact location of these 'power spots' can vary enormously per person, you should especially think of the chin, neck and above the elbow. The police deliberately use these places, for example to manipulate a detainee, but in healthcare that's exactly what you don't want.



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There are also sensitive spots that, if you touch them on a client, can lead to violent shock reactions. Approach them extra carefully and continuously check (feel) how the client reacts. It concerns the abdomen, face, inner thighs and pubic area.

Finding a sensitive spot and activating it is often very subtle. For example, when you place your hands on the back of the client's hands, he or she can sense in which direction the movement should go according to you. If you firmly grab the hands (no matter where exactly) for some clients this can lead to a pulling away movement that you do not want. But if you stand in front of the client and only lightly grab the hands the client will largely find the strength to stand on his own.

Of course, with such a standing movement, you need to know whether the client can stand up to any extent independently at all. Think of MK5 mobility class A or B. You should be able to find that in the file of this client. But even if you knew that the client has MK5 mobility class B and can therefore stand up fairly independently, it can happen that it does not work well. If you continue to communicate in a haptonomical way during the transfer, you will notice that soon enough.

Natural movement

When transferring, use the client's natural movements as much as possible (Hullu, 2018). That sounds nice and simple. Still, it's not always easy to figure out how your client gets out of bed, turns in bed, or puts on his shirt. First see how exactly you do it yourself. For example, check how you turn over in bed or see how your partner does that. Then delve into how older people, or people with disabilities, do that. That is often different. For example, young, fit people get up quickly from a chair, without moving far forward. Because of the speed they make when standing up, they don't have to bend so far forward. After all, the energy of the speed helps them up. The elderly and people with limited movement often cannot build up that speed or become dizzy when they get up quickly from a chair. Therefore, they must move more slowly and bend much further forward before they can rise to stand.



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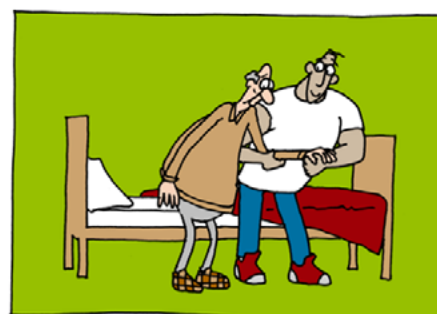
Something similar applies to clients who are extremely overweight. When people with the apple body type stand up, they first move their torso forward. People with the pear body type do that much less, they stand up more vertically.

Contact

Haptonomical movement is all about contact. You do this by continuing to feel how the client reacts to what you do and say. But making and keeping contact goes both ways: investigate, check and feel how you respond to what the client does and says. Try to maintain contact continuously. That can be non-verbal and verbal. Therefore, always tell exactly what you intend to do and what you expect from the client. Vague indications such as 'will you cooperate' or 'we are going to the physio' are often not clear enough. Keep it short, limit your message. If necessary, cut what you want to say into small pieces. Many clients do not remember longer stories. Be specific, say, for example, 'Would you like to grab the parrot' or 'Do you want to put your feet well under the chair?'

But no matter how concrete these two examples are, always support them non-verbally. For example, grab the parrot yourself while saying "Would you like to grab the parrot?" and place the hands on the client's shins while saying "Do you want to put your feet under the chair?"

Nevertheless, it can happen that you lose contact, for example because a colleague comes in. Then you start making contact again. This applies to all clients, but to an even greater extent for clients who have neurological problems, memory problems or poor vision. If these types of clients don't see you for a while, for example because you walked to the sink or to the other side of the bed, they may think that someone else is suddenly next to them. That is confusing, frightening and increases resistance.



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In this context, also consider whether it is not better to provide care for a particular client together with a colleague, or to go there alone. When you are alone it is often easier to keep in touch with the client. After all, there are fewer lines of communication: before you know it, you are chatting with your colleague, instead of with the client. And also, haptically it can be very confusing for the client if he or she feels four hands on his body, all sending out their own signals. That confusion can then turn into feelings of right or wrong, happy or sad, safe and unsafe. This arises pre-reflectively, it has already happened before we have thought about it (Finlay, 2005).

Timing

Another aspect in which we can make good use of haptonomical principles to make ADL care and transfers smoother for the client, and less physically demanding for the caregiver, is timing. Many caregivers count to three to indicate to the client and possibly a colleague when the transfer starts. There is nothing wrong with that in itself. Everyone involved then knows exactly when power must be supplied. Do this slowly, because explosive movement can lead to an enormous peak load on the musculoskeletal system.

However, it may happen that when you finished with counting, the client has not yet started to move. The client is in pain, stiff or just not fast enough. The temptation is then to largely take over the transfer itself. The client then experiences compulsion, resists and does not actively participate. After all, he is being pulled or pushed.

However, the haptonomy learns to wait (even if you are amply exhausted!) until the client initiates the movement himself. Only then do you follow that movement. In this way, the client is given the space to actually make a contribution, to be active and not to follow the speed of the care provider. Haptonomy is giving impulse, waiting and moving along.

Rhythm can also help with that 'promoting, waiting and moving' (Knibbe & Knibbe, 2010). Many clients are sensitive to rhythm. Moving (wiggling) together before a transfer can help to strengthen the sense of coordination in a certain rhythm. For example, in patients with Parkinson's disease, it can help to rock from one foot to the other while standing, so that they regain that sense of coordination a bit, so that they can start the walking movement again and continue. Do this slowly, continuously check whether the client goes along with the rhythm, support this with words and (the intonation of) your voice.

Practice haptonomy

Providing care according to haptonomical principles is not a trick that you can easily learn. After all, it is about systematically applying the basic attitude that you do not approach the client, as the founder of haptonomy already described it in the 1950s, as if he were a broken machine, but that you approach the client as a multidimensional human being (Veldman, 1988). That's complicated to learn through an article like this one. After all, it goes beyond words. We hope at least to have woken up your interest.



Copyright picture: Locomotion

On the other hand, some caregivers already work very haptonomically by nature, often without their knowledge. They feel and know that it works. Coach each other in this, learn from each other. Be curious if a client reacts very differently to you than to your colleague.

In addition, as a care provider you can experiment and learn in contact with the client every working day. Explore what distance does, what touch does. And grip, contact, timing? With your client, but also with you. You can also practice haptonomy in private 24/7. Sit next to someone on a park bench. Which of the three urinals do you choose if the left one is occupied? What does eye contact do when you meet a stranger on the street? Or how do you feel when you get a hug from an uncle on your birthday? How does someone shake your hand? Realise you mainly learn haptonomy by doing it.

11. Obese clients and physical load of caregivers

Knibbe, H. & Knibbe, N.

Obesity is a global health problem and, according to a recent study (2022) by the WHO, is also expected to increase in European countries. 59% of adults in Europe are overweight or obese. The percentages are rising rapidly, especially in the Mediterranean and Eastern European countries. The corona pandemic, in which teleworking and thus a sedentary lifestyle became the norm, contributed to this increase, according to the WHO.

BMI

Obesity is described as a chronic condition caused by excess body fat that harms health with an increased risk of premature morbidity and mortality (Wharton et al, 2022). In addition, obesity is the result of an imbalance between energy expenditure and energy intake of a person. The energy intake is then greater than the effective consumption, so that fat tissue accumulates in the body. This is associated with an increased risk of health problems, such as cancer and cardiovascular disease.

With the Body Mass Index (BMI) the weight status and thus the health risk of an adult can be roughly determined. It measures the ratio between body weight

(expressed in kg) and height squared (expressed in m²). The number obtained tells you which weight category someone belongs to. A classification system is used for this (see table 1). Persons who fall outside – both above and below – the standard values are said to have an increased health risk.

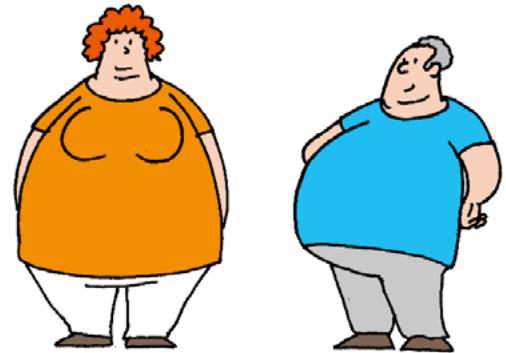
From BMI 25 we speak of overweight and a person is obese from BMI 30. This last group is further divided into three subclasses: obesity class I, obesity class II and obesity class III. Individuals who fall within this third obesity class are referred to as “morbidly obese individuals” or “bariatric patients.” They have a BMI 40+.

BMI (kg/m ²)	Classification	Health risk?
< 18.5	Under weight	Yes
18.5 – 24.9	Normal weight	No
25.0 – 29.9	Overweight	Yes
30.0 – 34.9	Obesity class I (moderate)	Yes
35.0 – 39.9	Obesity class II (serious)	Yes
≥ 40.0	Obesity class III (morbid)	Yes

Figure 1: Classification obese clients based on their BMI.

Physical load

When people suffering from obesity become dependent on care and become less mobile, the situation can arise that caregivers are physically overloaded because of patient transfers, washing, showering, etc. Two comparable studies (Wiggermann et al., 2021; Zhou & Wiggermann, 2021) show an increase in patient weight leads to an increase in lumbar compressive forces and caregiver hand strength when performing transfers. In another study, an increase in patient weight resulted in greater trunk and shoulder flexion while turning the patient in bed (Hwang et al., 2020). A survey of caregivers found that caregivers' back pain for a week or longer correlated with frequent transfers of obese individuals. Employees who used assistive devices reported fewer physical complaints (Galinsky et al., 2021). Also, the use of ceiling lifts to move obese patients significantly reduces muscle activity and compressive forces on the caregiver's lumbar spine (Choi & Brings, 2015; Wiggermann et al., 2021; Zhou & Wiggermann, 2021). These studies emphasize the risks for healthcare providers and the importance of using adequate aids and transfer techniques.



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Mobility

The BMI is very partly determinative of the physical load of the care provider when performing a transfer, if that care provider is mentioned in the story at all. After all, just as with people who are not overweight, it is much more about mobility, defined as the extent to which someone can carry out the transfer or the care task themselves. When determining policy, both at the level of the care organization and at the client level, the division into the five mobility classes (MK5) is a practical starting point.



Figure 2: The MK5, from A (leftmost) to E (rightmost) for obese clients (source: Arjo).

Body types

In addition to the classification based on BMI and Mobility Class, the body type also influences the choice of the safest way to move and care for the obese person. Broadly speaking, there are two body types, the apple and pear type. If the largest fat mass is around the abdomen, we speak of an 'apple', which in turn can be subdivided into two subtypes: the ascites distribution and pannus distribution (Figure 3). With a 'pear' the concentration of fat is somewhat lower, around the hips

and in the legs. Here too we distinguish two subtypes: the abducted distribution and adducted distribution (Figure 4).

By the way, heavy people usually don't really have a pure pear or apple shape, often there is a mixture of both. The weight distribution has consequences for, among other things, the way in which the obese client stands up. Someone with the 'pear' body type can bring the trunk quite far forward ('Vorlage'), and then stand up calmly and stably. If someone with the "apple" body type did that, he would fall over. The stand-up speed and stability are not fundamentally different for both body types. It is important that obese people have their own way of exercising. Hundreds of variations are also possible within the classifications 'apple' and 'pear'. Obese people often cannot stand up in a way that non-obese people can. So start from your own way of getting up. There is also a difference between people with an apple or pear shape in terms of the type of sling they need when transferring with a passive lift. Pear shaped individuals usually require an extra wide sling with good leg support. If there is an apple shape, an XXL sling is often sufficient. Sometimes extra support for the legs in the longitudinal direction is needed.

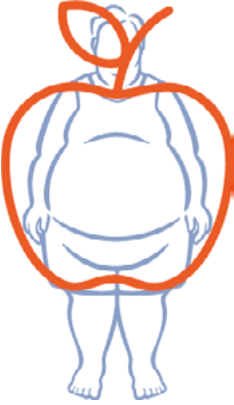
	Body type	Apple	
	Fat concentration	Around the belly	
	Characteristics	<ul style="list-style-type: none"> • The belly is usually hard • Waist circumference is larger than hip circumference • Knees and hips follow normal movement • Center of gravity is more at the front (risk of falling when bending forward) 	
	Types	Ascites distribution	Pannus distribution
	Characteristics	<ul style="list-style-type: none"> • Fat tissue: behind abdominal muscles • Belly is hard • Skin is tense • Respiratory problems in lying • Trunk flexion more difficult 	<ul style="list-style-type: none"> • Fat tissue: for abdominal muscles • Belly hangs • Skin less tense • Fewer breathing problems when lying down • Trunk flexion easier

Figure 3: Body type apple (copyright picture eUlift).


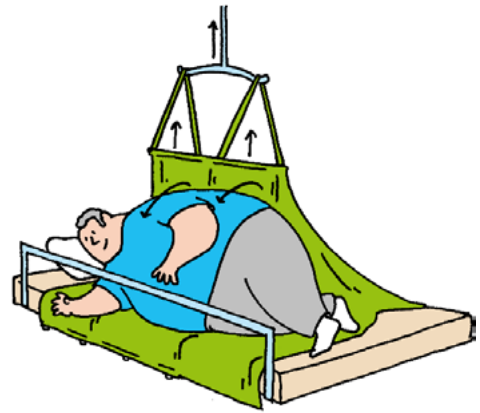
	Body type	Pear	
	Fat concentration	Around the hips and the legs	
	Characteristics	<ul style="list-style-type: none"> • Belly is usually not very big and hard • The waist circumference is smaller than the hip circumference • The legs are often less able to bend 	
	Types	Abducted distribution	Adducted distribution
	Characteristics	<ul style="list-style-type: none"> • Fat tissue: inner legs • Legs are spread in standing and sitting (abduction) 	<ul style="list-style-type: none"> • Fat tissue: outer thighs

Figure 4: Body type pear (copyright picture eUlift).

Practical Guidelines Physical Load

If we know which MK5 Mobility Class the person with obesity has, we can use the Practice Guidelines for Physical Load (Hignett, S., et al, 2014) to roughly determine when which type of aids are needed to prevent physical overload for caregivers.

Mobility class A concerns a fully active client who can carry out the transfers more or less independently. It is important to start from the spontaneous movement pattern, taking into account the body type (pear versus apple). Clients with Mobility Class B often use a transfer aid, but can do so more or less independently. Keep in mind that those aids must be strong, large and wide enough for the obese client. Someone with Mobility Class C has sufficient trunk balance, but little standing stability and therefore uses a standing or active lift. For transfers within the limits, a C uses a sliding sheet and, of course, an electrically height-adjustable bed.



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Also keep in mind that the aids must be suitable for the obese client. If the client is even less mobile (Mobility Class D) there is no more standing function and a very limited trunk balance. The client uses a sliding sheet and a passive hoist, both of course XXL. A Mobility Class E client is passive and completely dependent on third parties for movements. Encouraging self-reliance is no longer a purpose. For the use of the aids there are actually no differences with Mobility class D: a sliding sheet and a passive hoist.

In view of the obese target group, the use of aids from Mobility Class B means that they must in particular be extra wide and strong. Think of extra wide and strong shower chairs, beds, wheelchairs, etc. In addition, they are often equipped with extra smart features, for example beds with a built-in weighing unit. So, the obese client does not need to be moved when weighing.

A disadvantage of extra strong and wide aids is the weight. Maneuvering with a heavy aid and a heavy client can quickly result in physical overload for the carer. That is why more and more XXL aids are equipped with a motor, so that driving does not require any effort. This is not always necessary with hoists. Then a ceiling lift is a good alternative. An additional advantage of a ceiling lift is that less space is required. What is also nice is that the physical distance between the care provider and the client is smaller. Another advantage of ceiling lifts is that you can also easily turn the obese client in bed. The patient lies on a special sling that acts as a permanent sheet and can be attached to the ceiling lift on one side. Activating the lift causes the client to tilt.

Assessment

Before implementing a specific occupational health policy for obese clients based on BMI, MK5, body types and the Practical Guidelines for Physical Load, it is important to perform a risk assessment (Bone et al., 2015; Choi & Brings, 2015).

This can be done on two levels. First of all, it is important for the care organization to know whether the obese client can receive safe and respectful care at all at the location in question. For example, are the available lifters strong enough to move clients (MK5 classes C, E or E) weighing more than 150 kilos? Are the doors wide enough for an extra wide bed? How much weight can the hanging

toilets handle? How many kilos does the scale go up to? Are there extra wide chairs in the waiting room? Are the injection needles long enough (so that the medication does not leak into the surrounding tissue)? And what to do in case of calamities? For example, during CPR? The standard defibrillators are often not suitable for clients who are extremely overweight. And in case of fire or acute transport by ambulance? Is the ambulance stretcher designed for very heavy clients? And what should you do if an obese client has fallen? Is there contact with the funeral company about matters such as transport, size of the coffin, accessibility of the cooling and how post mortem care can be done respectfully (!)? In short, there is a lot to check beforehand. The BMI40+ Facility Check (see Appendix 1) is a useful tool for this.

TilThermometer

In addition, it is wise to check the extent to which caregivers are exposed to physical overload when caring for obese clients. The TilThermometer (www.tilthermometer.com) tests to what extent this is the case, also for obese people. As part of eUlift, the TilThermometer has become available in Lithuanian, Spanish, French and Hungarian. The instrument could already be used in Swedish, English and Dutch.

Techniques

The transfer techniques within eUlift have been specifically established for the transfer of obese persons. This concerns practical matters such as the body's center of gravity, which can be different from that of people without obesity, the abdomen that can get in the way or a smaller range of motion of the elbows and shoulders. The techniques are demonstrated in video on <https://eulift-app.com/>.

Shortness of breath

When obese clients lie flat in bed or sit up straight, the chest is under pressure and can cause shortness of breath. Pressure spots and bruising can also occur as a result of fatty tissue that is under pressure. Although this can happen in people with an apple and pear shape, it is important to be extra alert, especially with 'apples'. Putting the bed in an anti-trendelenburg (with the headboard higher) or 'half sitting' (somewhere between 30° and 60°) can then be practical solutions.

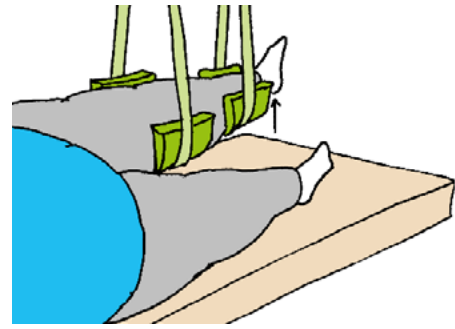
If the patient is moved with a passive lift (MK5 class D or E), a twin-motor ceiling lift can be useful. Because the motors can be operated independently of each other, it is possible to create sufficient space for the abdomen and to prevent tightness as much as possible. When the patient is moved with a lifter in a lying position, you can use a special sling with a series of adjustable length loops. Depending on the body type and width of the client, this allows you to increase comfort and also prevent breathing problems. Something similar can be done with a custom-made sling (which must of course meet all safety requirements).



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Skin

The skin deserves extra attention when caring for extremely heavy clients. The heavy perspiration and the sometimes very deep skin folds make skin care complex, heavy and time-consuming. Because obese people often find it difficult to wash and take care of themselves properly, the chance of 'missed spots' with the risk of infections and blemishes is high.



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For example, ask the client to lift the abdomen when washing in bed, possibly using a bath towel. In order to be able to reach everything well, it can be useful to raise an arm or leg with a lift. After all, it is essential that the skin is thoroughly dry after washing. Even if disposable washcloths are used ('care cleansing').

When touching, it is important to avoid large tensile forces on the skin. Due to the handling, the timing and the force with which this happens, shear forces are created on (and even in the skin), which can damage the skin. Therefore, touching should be done with the full hand as much as possible. This applies to both manual transfers (MK5 class A and B) and transfers with an aid (MK5 class C, D and E). More information about the skin problems in relation to lifting, transfers and physical strain of caregivers can be found in another chapter of this eUlift Handbook.

Respect

Caring for obese clients often presents a difficult dilemma. Healthcare providers may wonder why they should overload their bodies? While the client 'is to blame his- or herself?'

Then it is good to look at obese people from a different perspective. Knowledge of the background of the obese client is necessary. How did someone get so heavy? Often there is a world of problems behind it. After all, someone with obesity is a client with a chronic illness. No one is so heavy for their own pleasure. These people need care, just like people with a different disease.

Openly discuss the issue if a care team reacts negatively in advance to the arrival of an obese client. Look for solutions together with the client and his/her family. After all, this is often very annoying and sometimes even humiliating for the client. Of course, this does not mean that healthcare providers should go beyond their own mental and physical limits.

Summary

For an effective ergonomics policy aimed at the care of obese clients, there are four pillars: BMI, MK5, body types and the Practical Guidelines for Physical Load. It is useful in advance to do an assessment of the working space and aids already present (BMI40+ Facility Check), and the degree of exposure to physical overload of the care providers when caring for obese clients (TilThermometer). In the solution sphere, (transfer) techniques and aids are offered. Special attention is needed for respiratory and skin problems, as well as respectful communication with the chronically ill obese patient group.

Appendix 1: BMI40+ Facility Check (2.0)

BMI40+ ZorgorganisatieToets[®] (versie 1.0)

Hoeveel cliënten met overgewicht worden er verzorgd?

Je kunt hierbij gebruik maken van de indeling van bariatrische cliënten in vijf Mobiliteitsklassen (zie figuur 1 op pagina 8). Als dit nul of heel erg weinig is, kun je afvragen of het überhaupt nodig is om maatregelen te treffen. Een argument kan desondanks zijn dat je organisatie voorbereid wil zijn op de toekomst.

Zijn de bedden adequaat?

Ja Nee

- ▶ Is de maximale capaciteit (in kilo's) voldoende?

Het gaat dan zowel om het bed als om het (anti-decubitus) matras. Let ook op de maximale capaciteit van het hoofdeinde! Als dat onvoldoende is, kan de in bed zittende bariatrische cliënt achterover in bed zakken en zou zelfs kunnen stikken.

- ▶ Zijn de slides (voor de transfers binnen de grenzen van het bed) groot genoeg?

- ▶ Hebben de bedden voldoende instelmogelijkheden zodat de cliënt niet volledig horizontaal hoeft te liggen?

Dit is nodig in verband met ademhalingsproblemen die vaak voorkomen bij bariatrische cliënten. De meeste leveranciers bieden speciale bariatrische bedden aan. Let er vooral op dat er een speciaal middengedeelte is dat voorkomt dat de cliënt in elkaar gedrukt wordt op het moment dat het bed naar een zitstand gaat. Dat is ook bij niet-bariatrische cliënten prettig en belangrijk, maar bij bariatrische cliënten is het echt nodig omdat ze anders niet meer kunnen ademen.

- ▶ Zijn de bedden (met een bariatrische cliënt er in) veilig te manoeuvreren?

(Zie kader over manoeuvreren op pagina 27).

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Maak een virtuele rondje door je zorgorganisatie. Waar loopt een bariatrische cliënt letterlijk en figuurlijk tegenaan? Check of de volgende zaken BMI40+ proof zijn en vul eventueel aan:

Ja Nee

- ▶ toiletpot (hangend?!)

- ▶ steunen en beugels

Niet alleen de steunen en beugels zelf, denk ook aan de muur en de wijze van bevestigen.

- ▶ sproeiföhninstallatie

- ▶ weegschaal

- ▶ rollator

- ▶ ondersteek

- ▶ incontinentie materiaal

Het zwaarste incontinentiemateriaal (XL) is geschikt voor cliënten tot ongeveer 150 kilo.

Bij ergonomisch incontinentie materiaal is het mogelijk de heupband te verlengen met de band van een andere (eventueel al gebruikte) inco. Het verlengen doe je door middel van het klittenband.

- ▶ bloeddrukmeter

- ▶ personenlift

- ▶ lengte injectienaalden

Bij te korte naalden kan de medicatie weglekken naar het omliggende vetweefsel.

- ▶ hulpmiddelen die bij het zwachtelen worden gebruikt ter ondersteuning van de armen of benen

- ▶ hulpmiddelen en inrichting van het mortuarium

- ▶ _____

- ▶ _____

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- ▶ Zijn de eventuele hulpmiddelen die op het bed zijn bevestigd (papegaai, bedladder, etc) bestand tegen het gewicht van de cliënt? Ja Nee
- ▶ Zijn de bedden voldoende breed?

Anders kan de bariatrische cliënt zich niet goed bewegen in bed, of krijgt wonden van het beddek. Er zijn ook speciale bedden die smaller of breder ingesteld kunnen worden. De zorgverlener kan er dan beter bij om zorg te verlenen en het bed kan toch door de deuropening.



Zijn de stoelen voldoende breed en sterk?

Het gaat hier feitelijk om alle stoelen: poststoelen, douchestoelen, rolstoelen, luie stoelen, stoelen in de recreatie ruimte, etc.

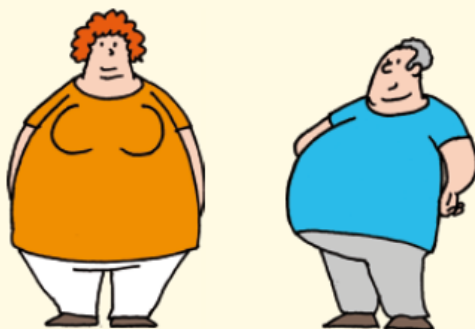
- ▶ Zijn de stoelen zo breed dat de billen niet vast komen te zitten tussen de leuningen?
 - ▶ Zijn de leuningen sterk genoeg om op te steunen?
- De maximale capaciteit is na te gaan op de gebruiksaanwijzing of via de leverancier.*

Zijn de tilliften adequaat?

- ▶ Is de maximale capaciteit van de lift voldoende*?
- ▶ Is de maximale capaciteit van de tilbanden voldoende*?
- ▶ Is het mogelijk de cliënt van de grond te tillen?

** Dit moet op de tillift of tilband staan (eis van de IGZ).*

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BMI40+ ZorgorganisatieToets® (versie 1.0)

Is er voldoende ruimte*? Denk daarbij aan: Ja Nee

- ▶ breedte van de deuren (in verband met een breed bariatrisch bed)
- ▶ extra ruimte rondom het bed
- ▶ gangen (kan overal de bocht gemaakt worden?)
- ▶ de liften
- ▶ natte cellen
- ▶ _____
- ▶ _____

** Sommige leveranciers bieden specifieke kennis aan over de ruimtebehoefte van hun bariatrische hulpmiddelen. Informeer daarnaar bij aanschaf en (ver)bouw.*

Etcetera

- ▶ _____
- ▶ _____

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12. Patient transfers and skin care

Knibbe, H. & Knibbe, N.

Ergonomically performing a transfer to prevent physical overload of the caregiver and at the same time prevent skin problems for the client (due to pressure, friction and shear forces during the transfer) is not always easy in practice.

Regular exercise, good nutrition, sufficient fluids and a good basic condition of the client are important in preventing pressure ulcers. Frequent repositioning also helps. By repositioning, the pressure on the body is always shifted to somewhere else, which reduces the risk of damage. But repositioning can be physically demanding for the caregiver. On top of this, incorrectly performing transfer techniques can even lead to skin damage.

Repositioning

Repositioning, individually determined for clients with an increased risk of pressure ulcers, is part of good care (Latimer et al, 2015; Serraes and Beeckman, 2016). However, research also shows that repositioning, an action that is intended to reduce the risk of pressure ulcers, can lead to a greater risk of pressure ulcers (Gefen et al., 2013; Oomens et al, 2014). We therefore run the risk of increasing the possibility of tissue damage for the client, instead of reducing it. At the same time, healthcare providers are more likely to develop musculoskeletal complaints.

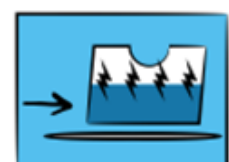
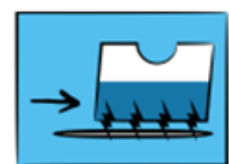
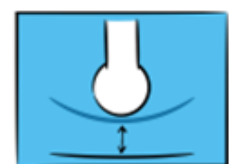
Many guidelines to prevent pressure ulcers indicate that you should not push or pull a client, but should lift. And that is exactly the opposite of what we would want from the point of view of caregivers' back pain prevention. Repositioning and other movements within the boundaries of the bed such as rolling over, sideways and up in the bed are in the Top 5 of the most physically demanding actions. The Practical Guidelines for Physical Load (CEN ISO TR 12296) indicate that you need an electrically height-adjustable bed and a slide sheet or similar device for this.

Pressure, friction and shear forces

When it comes to pressure ulcers, many factors play a role but, in any case, the following three aspects: pressure, friction and shear forces. By 'pressure' we mean the vertical pressure that is exerted by the client on the bottom area of contact (the mattress, the chair, the shower stretcher, etc.). This pressure causes tissue, but also blood vessels, to compress and close.

Friction occurs between the skin and the layer underneath the skin, for example when the client is sliding down in bed. Think of striking a match. And shear forces arise when tissue layers come under pressure and stretch relative to each other.

Especially the shear forces can lead to enormous damage in the tissues during transfers. For example, if a sideways transfer is done with a draw sheet, the sheet is actually pulling the client by his skin. First the sheet



Copyright picture: LOCOMotion

pulls by the skin and, when it is at maximum stretch, the tissues under the skin follow and finally the bone. The small blood vessels are put on stretch and therefore less blood can flow through. In addition, these now narrowed vessels are put under extra pressure ('reperfusion'), so that even less nutrition can reach the tissue.

But what can then be done to minimize the risk of pressure ulcers from performing transfers? After all, the same transfers are also necessary to prevent pressure ulcers. Here are nine tips.

Tip 1: Use double layer sliding sheets

To prevent physical overload of the caregiver when performing transfers within the bed, according to the Practical Guidelines for Physical Load in clients with reduced mobility (MK5, classes C, D or E), it is necessary to use a sliding sheet or something similar. Roughly speaking, there are three types of sliding sheets: the single-layer, the double-layer (two separate sheets) and the round-sewn double-layer 'tunnels'. Measurements (Knibbe, 2017) show pronounced differences between the risks associated with the use of single- and double-layer sliding sheets. With a double layer sliding sheet (two separate sheets or tunnel) there is less chance of friction and shear forces developing in or on the skin of the client. So there is a reduced chance of pressure ulcers. The realignment of tissue layers (so tissue returns to its original anatomical position) is also easier after the transfer when using double layer slide sheets.

Tip 2: Move steady

Research (Knibbe, 2017) shows that the force required by the caregiver to move the client with a double-layer sliding sheet is lower than with a single-layer sliding sheet. This reduces the risk of physical overload for the care provider, and thus the risk of musculoskeletal complaints. Belgian research by Maertens (2011) comes to almost the same conclusions. The difference in required strength is around 40%.



It also appears that small differences in technique can lead to large differences in pressure distribution and shear forces in the case of transfers with sliding sheets. This mainly concerns the explosiveness with which the care provider carries out the transfer. The highest pressure and shear forces are measured when the action is performed quickly and forcefully ('explosively'). If the action is done calmly and gradually, we see much less pressure and shear forces, and therefore less chance of skin damage. For educational purposes it can be practical to work with the 1,2, 3 rule: slowly build up the force in three steps.

Tip 3: Take the mattress into account

Research by Maertens (2011) also shows that working with sliding sheets is more difficult if the mattress is softer. After all, the client sinks somewhat into the mattress and is difficult to pull or push out of it. However, there are also mattresses with pumpless air systems that on the one hand offer good pressure distribution to the client and on the other hand are hard enough for performing transfers with sliding sheets. Another solution, which is rarely used in practice for transfers, is the 'care mode' that some beds offer. This makes the mattress a bit stiffer so that the client does not lie in a kind of dimple.

Tip 4: Get in lane

Getting in lane also limits the risks of pressure ulcers. By this we mean that the legs or feet of the client are already placed in the direction of the movement. The transfer is then divided into smaller parts. This is not only physically less stressful for the caregiver, it also reduces the friction, twisting and pressure forces in the client's tissue. An example of getting in lane is moving to the center of the bed in small steps (MK5 mobility class A, B or C). This prevents a combination of friction and sliding that otherwise often arises during the rotational movement of the buttocks on the mattress. This should be carefully assessed in case of hip issues.



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Tip 5: Move

It may sound superfluous, but it cannot be said often enough in the context of pressure ulcer prevention: **ensure that the patient moves as much as possible**. These can be small movements, as long as the local pressure is relieved for a while. In this way, the risk of residual tension and thus tissue damage is also limited. This is of course not only about the position in bed, the position in the chair or wheelchair can also give rise to pressure ulcers.

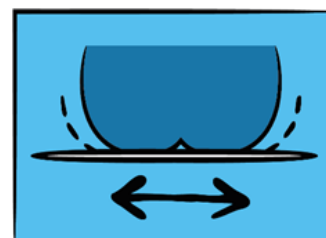


Copyright picture: LOCOmotion

Preferably, the clients naturally move by themselves. But if there is no other option, passive exercise is also a possibility. For example, by making optimal use of the adjustability of the bed. This is possible with traditional hospital beds, but also, for example, with an automatic repositioning bed system (Knibbe et al, 2018).

Tip 6: Increase contact area

The larger the contact area, the better the pressure is distributed. This reduces the risk of pressure ulcers, particularly in the well-known risk areas (back of the head, tailbone, hips, shoulders, heels). If the client is in bed, this can be done by making maximum use of the support options of the bed. Think of Fowler and Trendelenburg in all kinds of variations and combinations. With chairs and wheelchairs, a good occupational therapeutic fit is especially important to maximise seating comfort and thus minimize pressure on the skin and the underlying layers. For very passive clients, such as MK5 mobility class E, there are semi-sitting and lying orthoses that are specifically intended for pressure distribution.



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Tip 7: Let residual tension flow away

When completing the transfer, it is important to check that the client no longer has any tension in the skin and underlying tissue. Sometimes the residual tension can be recognized by folds in the skin, for example at the elbow or hips. However often it is not clearly visible and it is better to be safe than sorry. By, for example, having the client lift the arm or leg briefly at the end of the transfer, tension quickly disappears. In addition if the seated client wiggles back and forth, so the buttocks are released from the seat, this can have the same effect. And, of course, make sure that the surface on which the client is sitting or lying is smooth, without creases or wrinkles.

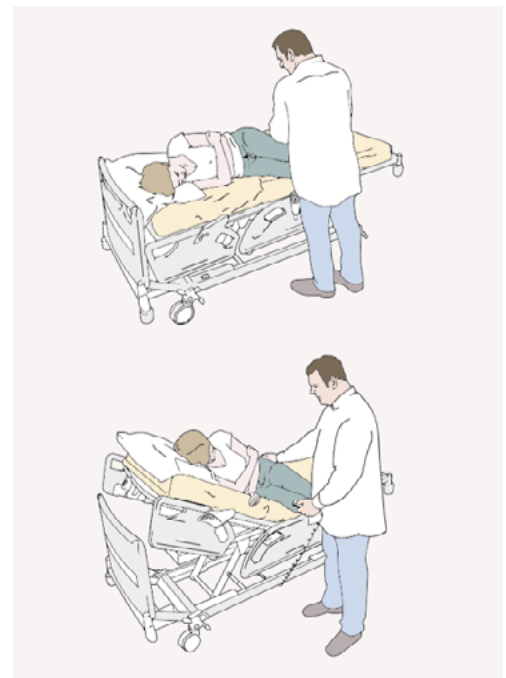


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Tip 8: Beware of friction

There are several solutions to prevent wringing of the skin during transfers. When the client is transferred from lying to sitting on the edge of the bed using the headboard of the bed, the contact area remains as large as possible and there is less friction: after all, the client does not turn over the tailbone.

Moreover, during transfers with a hoist, friction can be minimal as there is a large and even contact area because of the sling. Special beds, such as the mentioned automatic repositioning bed system and lifting sheets that can be linked to a ceiling lift system, can also be excellent solutions. These allows the client's reclining position to be varied minutely and at the same time to be supported evenly (Knibbe et al., 2014).



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Tip 9: Prevent moisture

During transfers, the moisture level of the client's skin is important for the risk of tissue damage. Moisture, for example during fever or incontinence, increases the friction between the skin and the underlying tissues (Fletcher et al, 2016; Folan et al, 2015; Francis et al, 2017). With dry skin, the friction coefficient is lower, shear forces are lower and the skin and underlying tissue are less vulnerable.



Copyright picture: Locomotion

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