

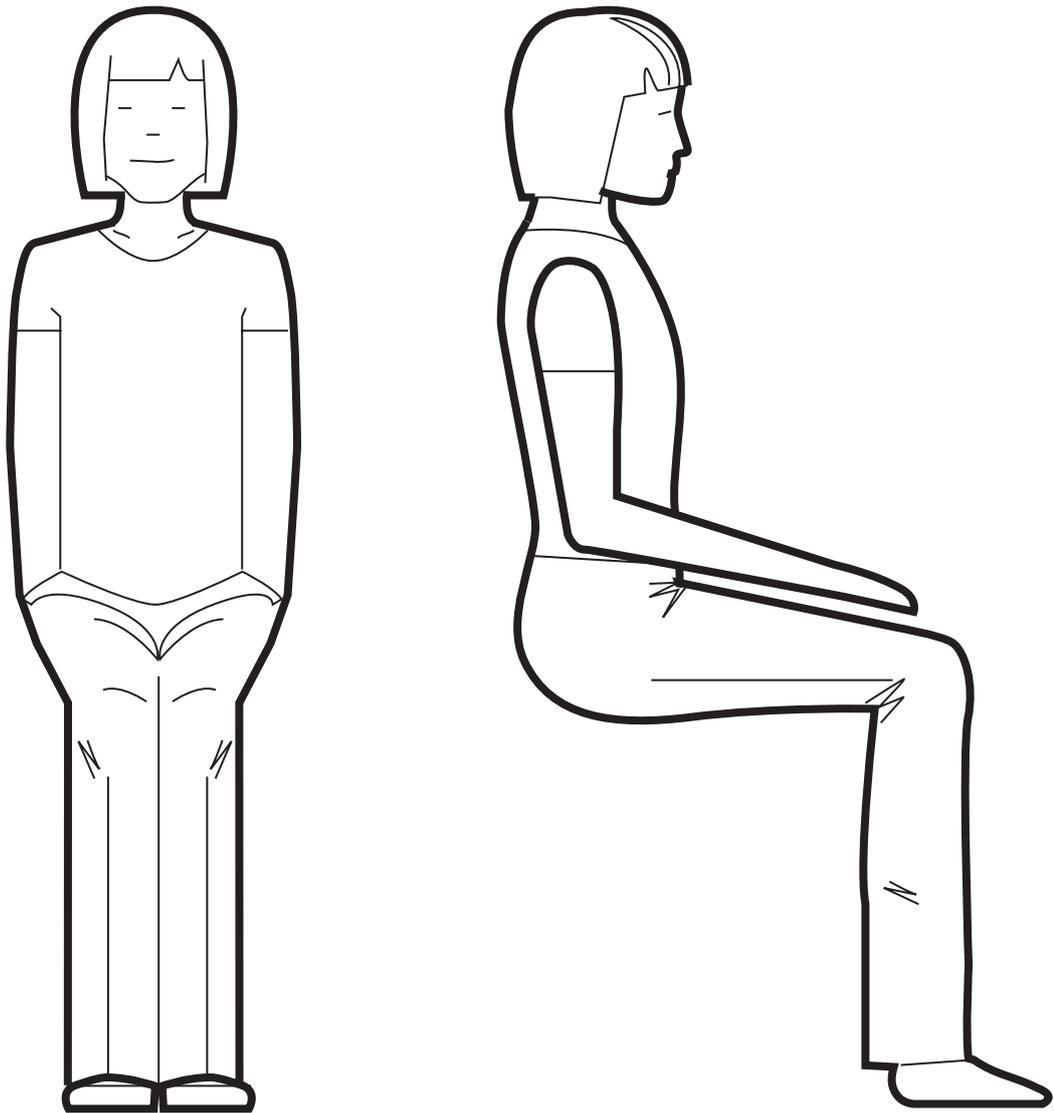
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# SITTING COMFORTABLY?

A user manual for wheelchair users

By Helle Dreier

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## **The manual wheelchair**

- When you sit down
- When you are sitting
- When you change your position
- When you are driving

## **Wheelchairs allowing for seating position adjustment**

- When you sit down
- When you are sitting
- When you change your position
- When you adjust your position
- Tilting function
- Recline function
- When you are driving

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- From the front
- From the side
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## PREFACE

This user manual has been compiled for wheelchair users, who would like to know more about wheelchairs, seating positions and pressure sore prevention. The idea is for this manual to supplement your personal knowledge and improve your ability to assess your own need for professional, impartial and product independent advice.

I hope that this manual can contribute to preventing serious physical, psychological and social consequences of pressure sores stemming from inappropriate seating positions and wheelchairs. I expect the manual to provide you with more ways of identifying your personal everyday risk situations in order for you to handle such situations as quickly as possible and before it is too late. I sincerely hope that this user manual will provide you, the wheelchair user, with sufficient knowledge and options to ensure that you are able to live your life the way you want to without having to suffer unnecessary deprivation.

No matter whether you are selecting a wheelchair or a washing machine, you should be able to make informed choices. Selecting a wheelchair is just a much more complex matter than selecting a washing machine. Selecting and adjusting a wheelchair is like tailor-making a suit or producing a pair of handmade shoes. In those latter cases, I am sure that nobody would question the need for a tailor or a cobbler. Not only must your wheelchair be able to transport you from A to B, it also needs to fit your body measures perfectly and be suitable to your everyday activities. That is what makes the choice so difficult. Small issues in your everyday life, or slight variations between two wheelchair models, might turn out to determine the most suitable product for you. It is vital to carry out an analysis of your individual needs in your own home.

You should be able to obtain advice from therapists working in the municipality or at the hospital treating you. You can also find therapists on the internet. You might want to carry out a search using words such as: seating assessment, seating position specialist, pres-

sure sores or pressure sore prevention. In this way, you might be able to locate a therapist close to your home. The most important task of such a therapist is to facilitate activity, and if you need certain aids in order to be able to carry out your daily activities, the therapist is required to make his or her knowledge on wheelchairs, cushions and transfer devices available to you.

My basis for compiling this user manual is my professional background as an occupational therapist. Next to more than twenty years of practical experience, I have also participated in developing a method of performing seating assessments, which has led to very good results with regards to prevention and healing of pressure sores and tissue damages connected to sitting. If you would like to know more about my professional competences, please visit my homepage: [www.tryksaar.dk](http://www.tryksaar.dk). In addition, the bibliography, which is provided as a download alongside this manual, contains a list of literature forming the basis of my practical experience and of this manual.

I would like to thank

## **TrygFonden**

for supporting me financially, thereby allowing me to compile this manual in the midst of a turbulent and busy life. I also want to thank those wheelchair users, who have assisted me throughout the process by reading and providing feedback on the material; I want to thank my colleagues, professional peers and other experts for their inspiration, feedback and support; I wish to thank those users with pressure sores, who have been in my care and thoughts; and last, but not least I want to thank "my" unusually helpful librarian, my patient and talented daughter and graphic designer Marie L. Dreier as well as all my other understanding family members and friends.

Helle Dreier 2010

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## PURPOSE

The purpose of this user manual is to improve your knowledge and options with regards to being able to sit in a wheelchair without having to run the risk of serious damages.

The aim is to focus on prevention.

First and foremost, the manual aims at preventing pressure sores and deep tissue damages; however, the intention is also to prevent long-term impacts of sitting in an inappropriately adjusted wheelchair. In fact, you can prevent both tissue damages and long-term impacts by following the same basic principles.

The goal is to avoid you getting into a situation where you feel forced to lie passively in your bed in order to relieve your bottom instead of actively living your life. The idea is to provide you with sufficient knowledge to allow you to change your situation if ever you might want or need to do so.

The idea is not for you to reduce your level of activity. On the contrary, you want to gain sufficient knowledge to ensure that you do not sustain damage by being active. In this way, hopefully you can still participate in all those activities that you enjoy in your everyday life. Nothing indicates that being active is a problem in its own right. On the contrary. However, being active does require your seating position to be just right and thus non-harmful to you.

Hopefully, you and your assistants will also be able to transfer this new knowledge to other risky situations that might occur in your life and in your everyday life in connection with sitting. Such situations might include being transported by car, being admitted to hospital or dealing with seating positions in other seats in cars, on planes, in beds or in other chairs.

Your body is unique, and your everyday life is full of your personal activities and ways of carrying these out. Therefore, many individual factors must be taken into consideration. This manual cannot possibly describe all situations in full. Instead, the aim is to shed light on the most important principles and point out certain typical risk factors in order for you to be able to improve your personal situation and seating posi-

tion within your personal everyday life.

The starting point of this manual is that you are the expert in your own life, in your own everyday life and on your own body; however, you do need impartial and product independent advice in order to make informed choices. If you use a wheelchair on a daily basis and sit in it for more than 15 minutes at a time, and if you have partly or completely lost sensibility, you ought to obtain professional advice from a therapist specialising in wheelchairs, seating positions and prevention of pressure sores. Because this means that you are at risk of sustaining serious physical damages caused by sitting.

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## PHYSICAL DAMAGES

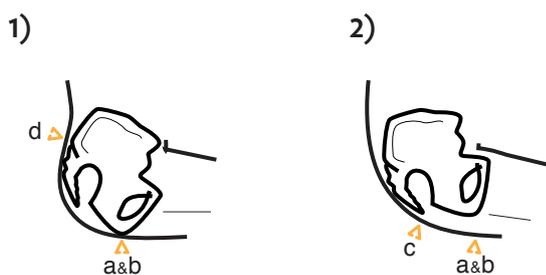
If your sensibility is reduced or completely missing, or if you suffer from reduced muscle strength, you are at risk of sustaining physical damages caused by sitting. Sitting might cause at least two types of serious damage.

### Damage to the musculoskeletal system (i.e. skeleton, muscles and joints)

This might lead to malpositions and pain, which – in the long run – might reduce your activity level and increase the risk of pressure occurring in particularly exposed areas.

### Damages on or under the skin

This refers to pressure sores or deep tissue injuries, e.g. close to the bones that stick out in your buttocks (buttock bones a & b or tailbone c) (drawing 1). Such damages might lead to life-threatening situations. They require quick reactions from both you and your assistants as well as acute assistance from people specialising in sores and seating positions. Luckily, both types of damages are preventable, and you can do a lot to prevent them. Your wheelchair must fit your body perfectly as if it were tailor-made for you. Many wheelchairs are adjustable in order to fit your body and activities perfectly; however, exploring these adjustment options to the fullest requires experience and knowledge. If you sit in your wheelchair for more than 15 minutes at a time, and if your sensibility is reduced or lacking completely, a wheelchair, which cannot be adjusted to fit your body, is not suitable for you.

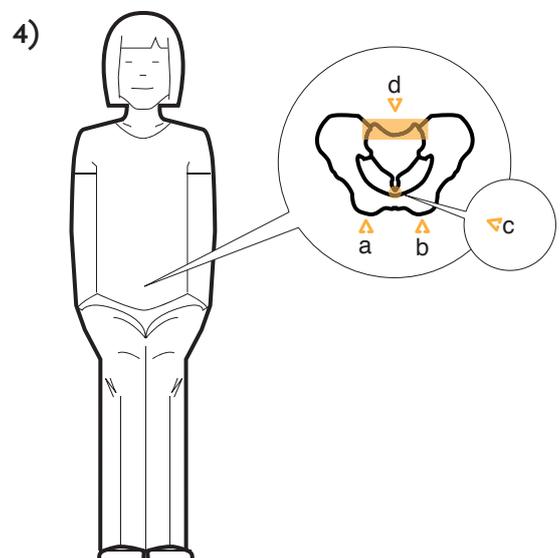


### Superficial skin damages

Pressure sores might occur in many different places on your body, typically where your bones stick out. This includes heels, calluses, the spine, shoulder blades and elbows. Often, these are friction damages occurring in connection with the use of inflexible bedding and clothing, material folds, nappies, lifting harnesses or inappropriate transfers involving barking the skin or hitting something hard whilst moving. Such damages are immediately visible on the skin.

### Deep tissue injuries beneath the skin

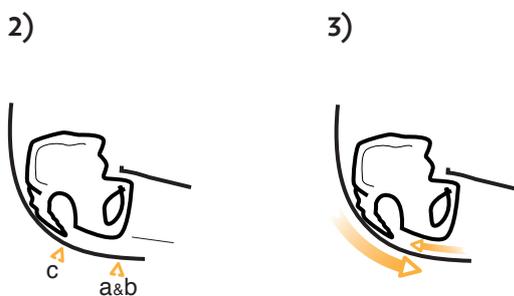
Many tissue injuries occurring in connection with sitting might develop beneath the skin over a longer period of time and unnoticed. This might happen deep inside the tissue, which is stuck between bones, fatty tissue and skin, when you are sitting. This type of tissue injuries does not always lead to skin reddening but it might suddenly turn up on the skin surface in the form of a small spot, pimple or boil after having developed unnoticed over a long period of time. Such cases typically involve significant underlying damages to the tissue located closest to the bones. These damages are called Deep Tissue Injuries (DTI), and they develop from within the deep tissue located closest to the bones and then move outwards towards the skin.



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Just keeping an eye on the skin on your bottom to ensure that it is not turning red and is still intact is therefore not sufficient to the wheelchair and the cushion through your 2 buttock bones a & b (drawings 1 & 4). Therefore, the surrounding tissue is exposed to a particularly high level of pressure. If, at the same time, you are sliding slightly forward in the seat because you are not sitting in a completely stable position, your buttock bones will simply tilt backwards. This causes the tissue to be compressed and deformed, and shear starts to develop (drawing 3).



## BODY SIGNALS

It is very important that you think about your body's signals and react to any kind of pain and discomfort that might be connected to your seating position.

Using an inappropriate seating position, which strains your body, can cause general discomfort.

Potentially, such discomfort might be a sign of deep tissue injuries that have yet to surface.

If you suspect that something is wrong, you need to seek medical advice as soon as possible. At the same time, you need to obtain assistance from a therapist specialising in seating positions. In cooperation with the therapist, you can explore the possibilities of improving your situation.

If you have sustained tissue injuries to your bottom around the buttock bones or the tailbone, those injuries have most probably occurred because you have been sitting for more than 15 minutes in an insufficiently adjusted wheelchair, armchair, sofa or bed, or in an inappropriate car or plane seat.

If you wish to keep sitting, you need to have a thor-

ough analysis of your seating position and your transfer devices carried out. In this way, you will find out which factors related to your wheelchair and your everyday life might have caused your pressure sores to develop. It might be necessary to change some of your daily routines in the wheelchair or adjust certain factors related to the sitting furniture that you use in your everyday life – including your bed. You might also need to avoid certain risky procedures for a while, e.g. related to transfers; however, such issues would need to be thoroughly analysed.

## EXTRAORDINARY INCIDENTS

You might be carrying out certain everyday procedures in one way at home but in a different way when you are in hospital or on holiday.

Deep tissue damages might have developed during extraordinary incidents.

As an example, if your general physical state has deteriorated significantly following a prolonged bedrest, you being discharged and attempting to handle your everyday life as usual will often lead to extraordinary and critical situations. You need to consider such a discharge an extraordinary incident and prepare yourself for it by evaluating and testing risky activities and procedures at home in cooperation with experienced therapists. In this way, you will be able to find out whether you need to look for temporary alternative procedures, e.g. by using alternative transfer devices for a while until you have regained the strength in your arms.

An extraordinary incident might also include holiday, visiting friends and family or being admitted to hospital. You might have had to sit for a very long period of time without being able to adjust your seating position, or you might have been sitting uncomfortably in a plane seat, a bus seat, a car seat or in an inappropriately adjusted wheelchair that was not your own.

If you are facing an extraordinary situation, e.g. when going on holiday or being admitted to hospital, it is always recommended that you obtain information ahead of time and that you communicate your spe-

cial needs with regards to transfers, bed adjustment functions, mattress quality issues as well as toilet and shower facilities. In this way, you will be better prepared to prevent undesirable impacts on your body. If possible, bring your own wheelchair and, if necessary, have a therapist adjust it to your current state and the situation in question.

## CENTRAL SEATING POSITION FACTORS

In order for you to contribute to the prevention of tissue damages and other physical damages caused by sitting, you need to understand the meaning of three central factors that affect your ability to obtain a non-harmful seating position.

1. **Stability**
2. **Pressure distribution**
3. **Carrying out everyday activities**

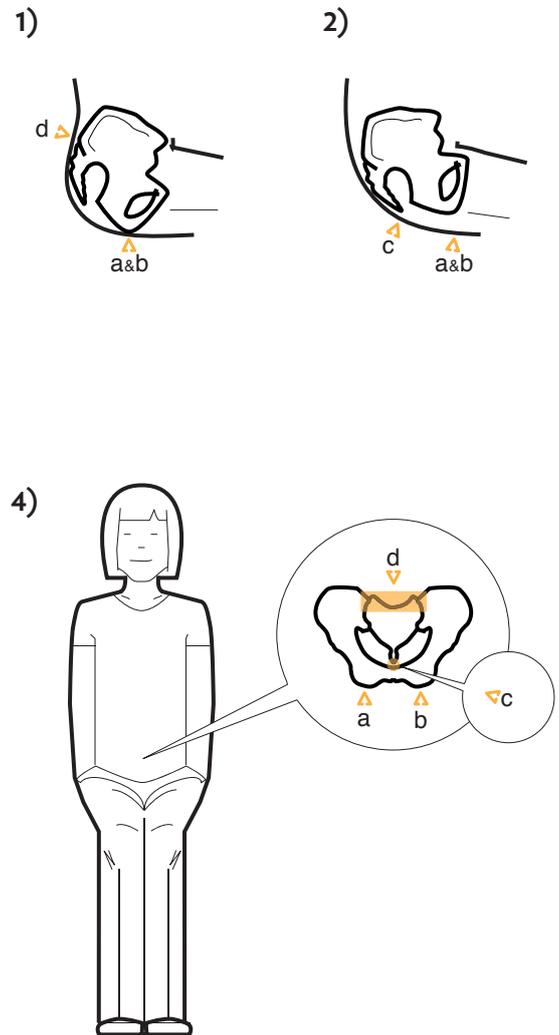
### 1. Stability

If your sensibility is reduced or lacking completely, you are at risk of developing pressure sores or deep tissue injuries. In this case, when selecting a seating position it is important for you to highly prioritise the stability of the entire body.

Stability will prevent you from sliding forward in the seat; however, you should NEVER attempt to prevent sliding by sitting on an anti-slip material! This would only hide the visible problem whilst increasing the development of shear that causes deep tissue injuries. Thus, the risk of sore development would increase.

### Buttock bones

In order to create stability for the entire body within the seating position, you primarily need to consider the 2 buttock bones a & b, which you are sitting on and which you can feel underneath each buttock (drawings 1 & 4). These bones are, however, not shaped to stabilise your body on their own. They are



more or less shaped like the rockers on a rocking chair (drawings 1 & 2), and if they are not supported by a 3rd support point, they will tilt backwards.

Many people think that the tailbone c (drawings 2 & 4) needs to take on the role as the 3rd support point; however, this is rarely appropriate. Actually, the tailbone should only then be used as the 3rd support point, if that is the only way to obtain an appropriate seating position.

## The 3rd support point

In reality, the 3rd support point is more like the area d than an actual point. It is located at the lower back where the hip bone and the spine meet (drawings 5 & 6). More precisely, the area is defined as the connection between the spine and the sacral spine (drawing 4), i.e. it is located higher up on the back than where the tailbone c is located. Take a good look at the drawings and try to localise those points on your own body when looking in the mirror. You might ask an assistant to localise the points on your body for you. It is particularly important that the 3rd support point includes the sacral spine but it is also helpful if it reaches out to the large hip bones, which you can locate by the sides of your waist and follow all the way to your back (drawing 4). The support point must be fixed and precise because it is needed to support and stabilise your pelvis in a neutral, upright position on top of the buttock bones a & b (drawing 1). In this way, you also gain support for the natural curve of your spine, which then functions as a self-supporting construction. This makes your head balance without you having to spend unnecessary energy keeping your head upright. At the same time, it creates stability for the entire body and you avoid malpositions and sore shoulders or a sore chest, neck and throat (drawing 6).

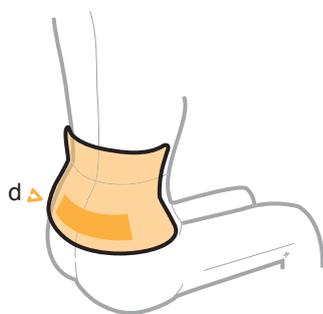
As you can see, it is your very own skeleton delivering stability within your seating position; however, you also need to assist your skeleton in doing so by having the wheelchair fit your body curves perfectly in both the seat and the back.

So, you need the three support points a, b & d (drawing 1) to cooperate with the wheelchair in order to keep your pelvis in a neutral position (drawing 6), thereby preventing it from tilting backwards. If your pelvis is tilted backwards, you will automatically end up sitting on your tailbone c, which is not desirable (drawing 7).

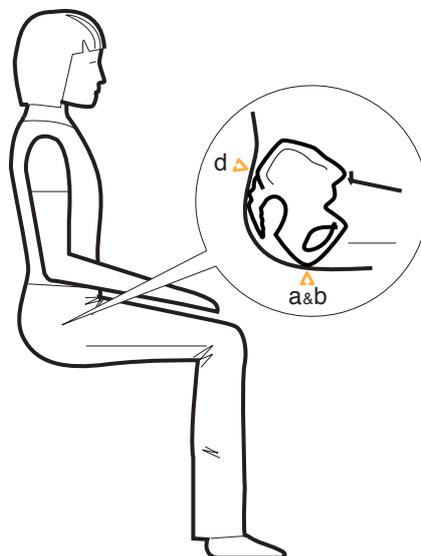
## If the tailbone is your 3rd support point...

If for some reason it is not possible to stabilise your pelvis in a neutral position by means of the three support points a, b & d, in exceptional cases you might need to use your tailbone c as one of the three support points. If this happens, your pelvis will tilt backwards (drawings 2 & 7), at the same time unfortunately causing you to lose the possibility of utilising the innate ability of the spine to function as a self-supporting construction. This means extra muscle work in order to keep your head in an upright position, and usually this will also lead to reduced freedom of movement for your arms and upper body.

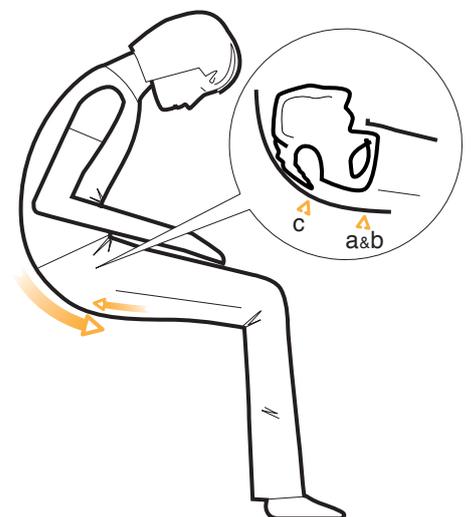
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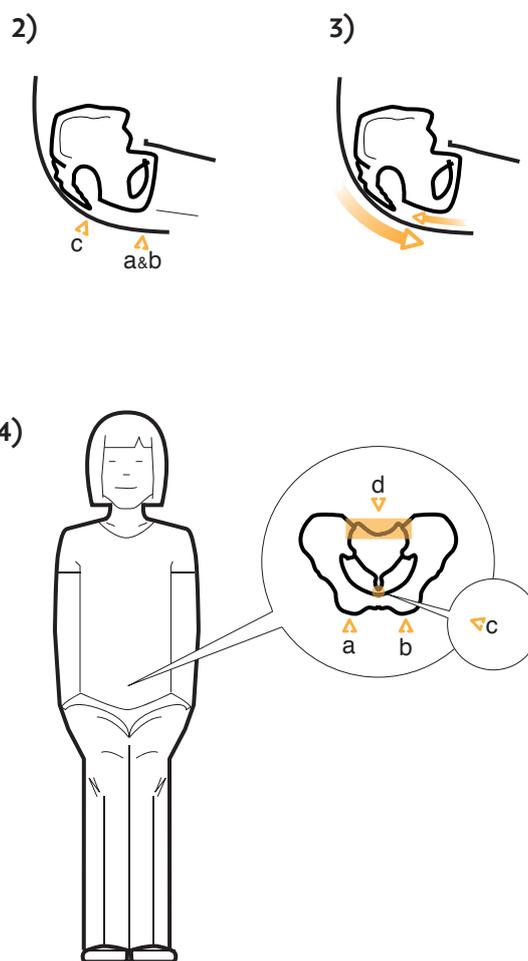
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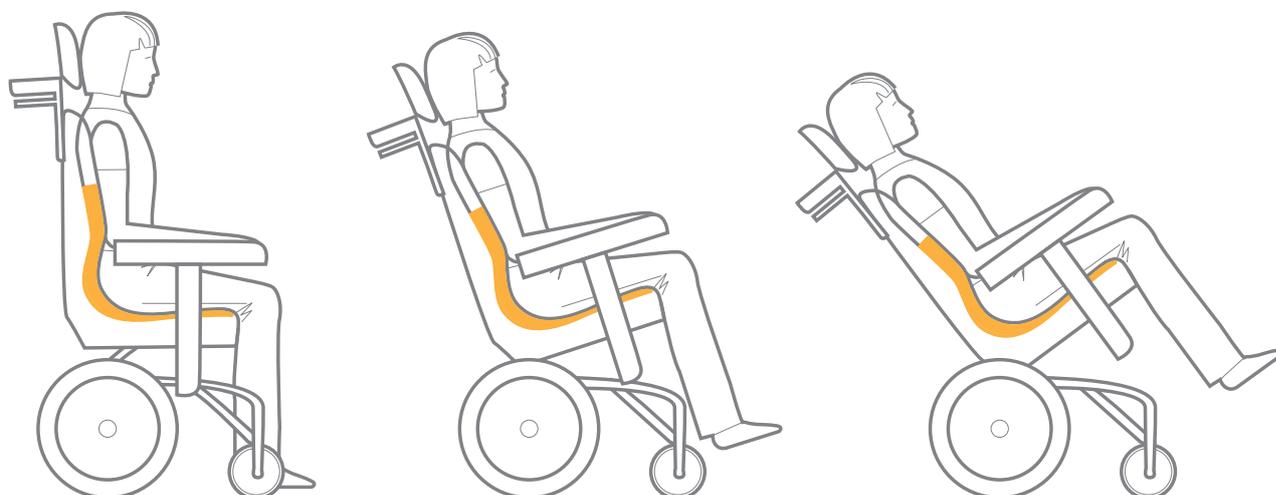
At the same time, such a position might lead to an increased risk of shear in connection with the buttock bones a & b and the tailbone c (drawing 3). Therefore, if your pelvis is tilted backwards and you are using the tailbone c as the 3rd support point, these issues will call for extra attention when selecting a suitable cushion. If your tailbone c makes up the 3rd support point, you will usually need to select a cushion product, which is able to join the body in that forward sliding movement, which will inevitably happen throughout the day. Selecting the right cushion requires the help of an expert, who has an in-depth, product independent and impartial knowledge of relevant cushions available on the market. In addition, utilising the ability of the wheelchair to change its position must be considered when using tilting (drawing 12).

### 2. Pressure distribution

Pressure on particularly exposed areas (e.g. on the buttock bones a & b or the tailbone c) can be minimised by increasing the size of the total area on which the body touches the wheelchair. This is either done by shaping the wheelchair seat and back to fit your body perfectly or by distributing some of the pressure to your forearms and the soles of your feet.



12)



It is common to imagine that pressure distribution is a matter of distributing the pressure between the wheelchair seat and the cushion but one should also explore the possibility of moving some of the pressure to the contact area between your back and the wheelchair back (drawings 5 & 8).

## The wheelchair back

The wheelchair back must be adjusted in such a way that it encases the sides of the lower part of your back as much as possible, and so that it fits to the shape of your back (drawing 5). If you are a man, it might be a good idea to select a wheelchair with a back that is shaped to fit a person, whose shoulders are broader than the hips. If you are a woman, it might be a good idea to select a wheelchair with a back that is shaped to fit a person, whose hips are broader than the shoulders.

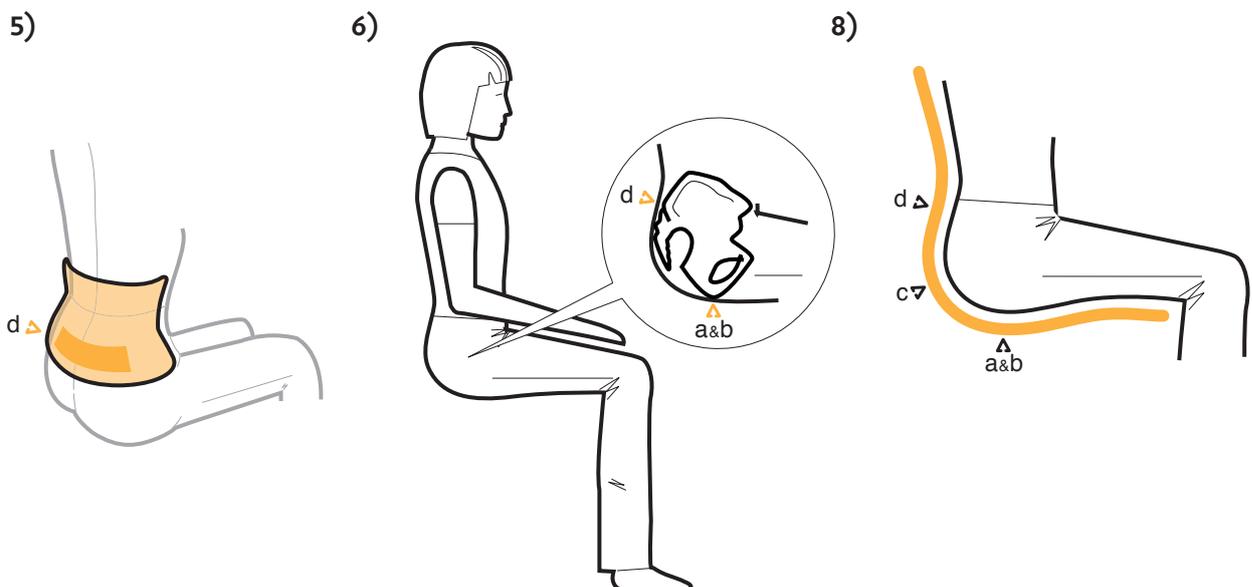
In addition, the wheelchair back must be perfectly adjusted to support the 3rd support point in the area where the spine and the sacral spine are connected (drawings 5 & 8).

When the wheelchair back is correctly adjusted, you are able to sit and keep your head balanced at the top of your spine without having to spend energy keeping your head in place. In this way, you will easily be able to look around without having to strain yourself and without feeling any tension in your upper body, shoulders or neck. At the same time, the pressure distributing area is increased and the risk of sliding forward in the seat is reduced.

The optimal height of the wheelchair back is usually level with or lower than the lower tip of your shoulder blades. If the wheelchair back is higher than that, you need to be aware that it might hinder the natural curve of your spine and/or prevent your arms from moving freely. This might be a problem if you are supposed to move the wheelchair manually by means of grip rings.

## The wheelchair seat

Anatomically your skeleton is constructed in such a way that when you are sitting, the two buttock bones a & b on your pelvis reach some 3 cm deeper into the base than your femur bones do (drawing 6).



In order to distribute the pressure in the best way possible, this means that the shape of the seat surface must fit the shape of this part of your body perfectly. Therefore, the wheelchair seat shape must be approx. 3 cm deeper at the back in the spot where your buttock bones are located when you are sitting (drawings 8 & 10). You have to imagine that what you are sitting on needs to be a kind of a cast of you.

If the base or the cushion is inflexible, this might mean insufficient space for your two buttock bones a & b. As a result, your muscles will get stuck and be exposed to a significantly higher risk of pressure than if the seat base and the cushion fit your bottom perfectly. At the same time, it will be difficult to stabilise your pelvis in a neutral position – i.e. on top of the rockers of the buttock bones (drawing 6) – which would also make it difficult to prevent the tissue from being exposed to shear (drawing 7).

## Cushion

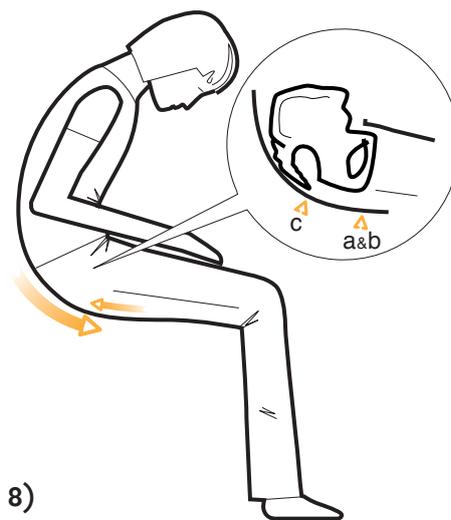
When you select a cushion, make sure that the seat base and the cushion match. If the seat base is to be tightened or is made up of a fixed plate, which cannot be shaped to fit you, the cushion needs to be thick enough to allow your buttock bones a & b to sink into the cushion material at a level similar to those additional 3 cm reached by the buttock bones.

If, on the other hand, you are able to utilise the fact that the seat base below the cushion can be shaped according to the depth reached by your pelvis bones, you need to select a cushion that fits the shape of the seat as well as the shape of your bottom and the additional 3 cm needed by your buttock bones (drawing 10). The advantage of this type of pressure distribution system is that the cushion does not have to be quite as thick and that it allows you to obtain a high level of stability through the combination seat base/ cushion.

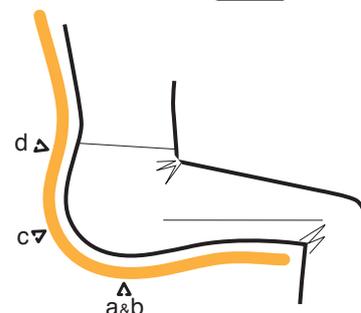
The pelvis bones must not be able to reach through the cushion material to hit the seat base. If this is the case, the pressure distribution is insufficient.

It is recommendable to seek professional and impartial advice concerning the choice of cushion in order to ensure good interaction between buttock bones, bottom, seat base and the cushion.

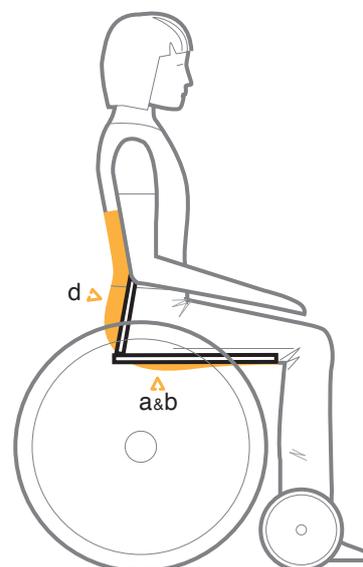
7)



8)



10)



## Armrests

The armrests are intended for body weight distribution and support of resting arms. Therefore, it is important to adjust them to the right height. You can distribute approximately 10% of your body weight to the armrests, making them quite important.

## Foot rests

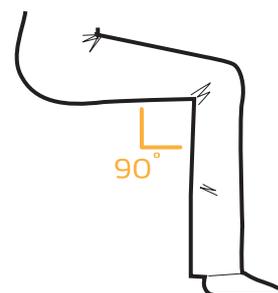
- Foot rests are used to increase the pressure distribution area. This requires the sole of the foot to be able to support the foot and the weight to be able to distribute itself vertically (drawing 9).
- If the feet are malpositioned, certain special support measures are required. You need professional help to solve this issue.
- The distance between the hollow of your knee and the soles of your feet – i.e. the length of your lower leg – must equal the distance from the upper edge of the seat to the footplates. You have to make sure that the entire back of your thighs are supported. This is important for the purpose of pressure distribution. If the distance is too short, your knees will be elevated too much, causing your body weight to rest too heavily on your buttock bones only. If the distance is too long, the front of the seat will apply pressure to the back of your thighs, thereby hindering blood circulation and nerve supply. Try to find out whether your body and the seat surface fit each other well by sliding your hands under your thighs. If you are unable to do so, ask your assistant to do it for you. A good fit also ensures proper pressure distribution.
- If you sometimes wear different shoes with a different height, remember to adjust the distance from the upper edge of the seat and the footplates. You might want to consider this issue when shopping for new shoes in order to avoid this potential source of irritation in everyday life.

- Foot rests facilitating a knee angle of 90 degrees (drawing 9) offer the best possibility of distributing at least 10% of your body weight in this manner. Such foot rests are usually available as standard wheelchair features; however, sometimes you have to ask for them.
- In terms of developing tissue damages on the bottom, the use of elevatable leg rests makes up a disadvantage and a risk factor for several reasons. Amongst other things, they often disturb the vital stability of the seating position by preventing the legs from being placed at a 90 degree angle (drawing 9). When lifting up the leg rests towards a horizontal level in order to stretch the legs a bit, you also inevitably pull your pelvis a little bit, causing the buttock bones to tilt backwards (drawing 3). This is not a particularly desirable situation given that you actually want to improve the pressure distribution.
- You might have been told that elevatable leg rests prevent the legs from swelling. Unfortunately, this is rarely an option because it requires the legs to be elevated to above the height of your heart. First of all, this would require your head and heart to be placed at a lower level than the level of your legs, and carrying out such a procedure would involve the risk of shifting your seating stability and reducing pressure distribution when returning to a sitting position. If you need to treat or prevent swollen legs, it is much better to do so in bed.

3)



9)



### 3. Everyday activities

Luckily, you can do a lot to contribute to the prevention of physical damages as long as you are familiar with the basic prevention principles described in this user manual in the sections 1. Stability and 2. Pressure distribution. It is impossible to predict and describe all possible risky situations that might occur in your everyday life; however, if you and your assistants understand these principles, you are well-prepared to come up with your own solutions to various everyday issues. If you find it too difficult, you may always seek advice and guidance from a therapist specialising in body, assistive devices and activities. Whereas an outsider's eyes might see things differently, your own common sense is definitely also an important tool.

You particularly need to explore your everyday surroundings to identify potential risk factors. Take a critical look at your daily personal procedures with regards to the use of your wheelchair, your cushion and your transfer devices.

You need to include every little detail – also the ones that you consider to be only trivial matters. Simply imagining what you are going to do, once you are back home, is not sufficient. It is also not sufficient just to tell somebody how you usually do things. You really need to try things out at home using the assistive devices that have been provided to you in your home. You might need a sparring partner to assist you in analysing those situations in a thorough manner. In this way, you can come up with specific and realistic solutions to fit your individual and unique everyday life.

If you want to assume responsibility for preventing physical damages, it is absolutely essential that you gain an insight into the ways in which you can actually carry out your everyday activities. You need to analyse all risky movement patterns with regards to inappropriate procedures in order to obtain the optimal stability and pressure distribution levels within your seating position.

Consider this a detective's task and keep looking for further suspects. Your everyday activities might be

packed with risk factors.

This might include the way you sit down in your wheelchair or the way you sit in it. It might also include daily procedures related to toilet visits, showering or resting in your chair. It could also include kitchen activities related to cooking or eating, or activities that you carry out whilst lying in bed. Most activities may be carried out in various ways. You need to identify those ways that carry the smallest risk of compromising your stability and pressure distribution levels.

#### About sitting

Sitting is an everyday activity.

We are not supposed to think about the fact that we are sitting when we are. When we are doing something else, sitting is not supposed to be an issue.

When your wheelchair has been adjusted correctly to fit your body, the most important point in time will be the moment when you sit down.

#### About sitting down

So, it is the process of sitting down in the correct manner, which is important for your stability and pressure distribution in everyday life. At the same time, you being aware of how you sit down is also your way of preventing the development of shear (drawing 3).

3)



#### About transferring to the wheelchair

Transfers TO a wheelchair, car seat or other types of sitting furniture are the most important ones. Such transfers must form the base of ensuring a stable and non-harmful seating position when sitting for a long period of time. A transfer well-done is a big step towards ensuring a healthy seating position. How your transfers FROM the wheelchair take place is not important for your seating position.

## About transferring to the wheelchair without the use of assistive devices

If you do the transfers on your own, it is important that you finish your transfer by lifting yourself completely from the surface that you are sitting on. Perhaps you need to sort out your clothing following the transfer, or perhaps you pull yourself across the seat into the final seating position. In any case, you need to elevate yourself for a moment in order to allow the tissue to fall back into place so that you do not end up sitting on tissue being exposed to shear.

If you have been bedbound for a longer period of time, you might have lost some of the strength in your arms, meaning that you are no longer able to lift yourself the way you used to. In that case, you will need to identify other ways of transferring yourself for a certain period of time. A temporary alternative, e.g. assistive devices, might prevent your bedrest from causing serious tissue injuries. You might want to ask the local authority therapist to assist you in finding a suitable solution to cover the period of time needed for you to regain the strength in your arms and be able to do the transfers the way you used to.

If you need a person to assist you in transferring yourself e.g. from your bed to your wheelchair, it is recommendable to use assistive devices instead. An appropriate transfer requires more than just a person to assist you in order to obtain the needed stability and pressure distribution within the seating position, ensuring that all three support points a, b & d (drawing 1) on your pelvis are in contact with your wheelchair to the extent needed. A large selection of assistive devices and transfer methods are available, and you might be able to use those as an alternative method for the time being.

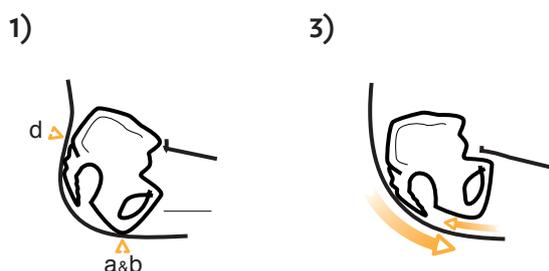
## About transferring to the wheelchair with the use of assistive devices

If you are using transfer devices, you should avoid pulling your bottom across the seat in case you have ended up not quite sitting in the place where you would like to sit. If your assistants decide to pull the back or the sides of your trousers in an effort to move you, such a situation could cause tissue damages. If there is a need to adjust your seating position, this must be done using the sling whilst you are still in it – i.e. whilst you are completely off the seat surface. Using a different sling or changing the procedure slightly in accordance with the principles pertaining to 1. stability and 2. pressure distribution might improve the transfer.

Your end position in the wheelchair following a transfer must be right from the outset. This means that even if the transfer has gone just slightly wrong, it has to be repeated immediately. For the same reason it is also important to adjust your clothes whilst you are still hanging in the sling in order to avoid pulling your bottom and your buttock bones just that little bit forward, which might cause your pelvis to tilt backwards (drawing 3). If this happens, the possibility of stabilising your pelvis in a neutral position by means of the three support points a, b & d (drawing 1) is no longer provided, meaning that you need to start the process all over again: sitting down.

## About lifting

If you do not have the power to lift yourself up completely from the seat surface once you have sat down, the most optimal way of doing so is by using a ceiling lift. A ceiling lift provides the best possibilities of ending up in the optimal seating position, i.e. on top of the buttock bones a & b, stabilised by means of the 3rd support point d located on your lower back (drawing 6). You want to adjust your seating position once you have sat down, because if you fail to do so, you might be jeopardising the healthy base position needed in order for you to be able to sit in a stable, pressure relieving and risk-free manner for hours upon hours.



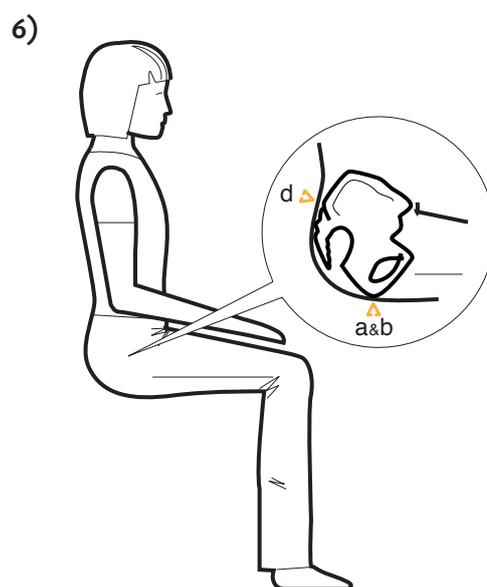
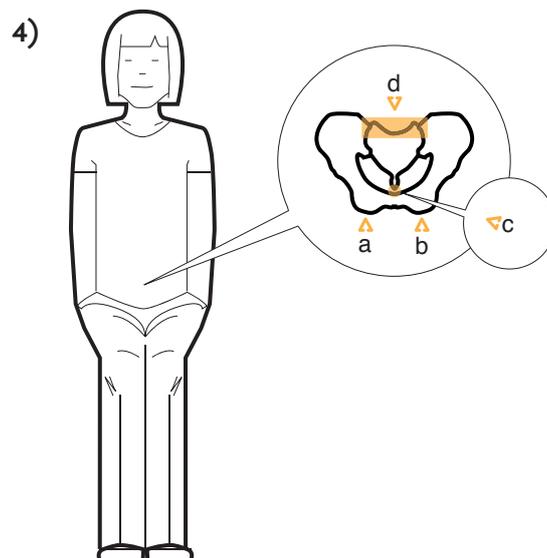
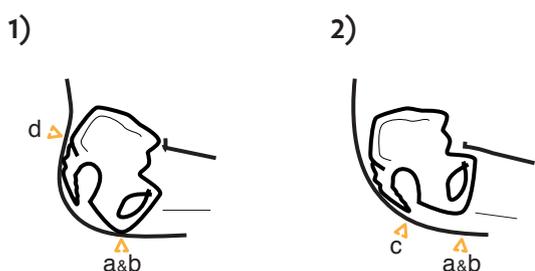
### About lifting slings

Lifting and transfer methods involve various types of needs, procedures and assistive devices. Depending on the extent of your disability, a suitable method will be chosen for you.

- Often, selecting the right sling can really make a difference and improve the transfer. Slings should be shaped in a way that makes the seating position within the sling resemble the final wheelchair seating position as much as possible. Therefore, it is important to prevent the sling from turning your body into a banana shape. Instead, the sling must enhance and support the natural curve of your spine (drawing 6). Small, low slings are usually the best way to ensure the natural postural sway; however, the slings must be tested on each individual person prior to selecting one. During the sling transfer, and when you are just about to be sat down, it might be a good idea to use some type of hip bone support from the front (drawing 4). This is a means of ensuring that your pelvis is going to end up being placed symmetrically on top of your buttock bones a & b (drawings 1 & 4). Pushing your hip bones from the front, rather than pushing your knees, ensures a much better work position for your assistants as well as a better seating position for you.
- The lifting sling must be easy to put on and particularly easy to remove. This ensures that the stability of your seating position and your pelvis

is not shifted. When the leg straps are to be removed and the trouser legs are to be pulled into place, it is important to do so very carefully and without lifting the knees. Even tiny buttock bone movements might shift the starting point for the 3rd support point d, thereby jeopardising the seating position stability needed.

- If this happens, your bottom will slowly slide forward and you will end up sitting on your tailbone c (drawing 2). Then your upper body will slowly



but surely collapse and be weighed down by your head (drawing 7). Such a situation implies a great risk of shear within the tissue and an increased risk of deep tissue damages. In addition, you attempting to keep your head in an upright position in order to see what is going on around you might lead to pain and soreness around your back, neck and shoulders.

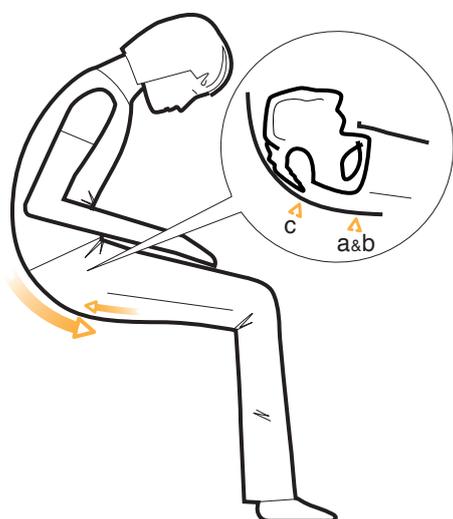
- It is important to remove the lifting slings after use, and slings that are designed for people to permanently sit on them should not be used. They increase the risk of sliding forward, thus increasing the risk of tissue damages caused by shear. Lifting sling materials are inflexible and they are equipped with some very heavy seams, which might lead to pressure injuries.
- Avoid having to dismantle foot and leg rests prior to carrying out a transfer. Having to put them back on following the transfer usually disturbs the seating position stability, which the transfer is supposed to create. Avoid having to lift or stretch your legs forward during and after the transfer. Prevent your feet from getting stuck on calf plates, heel straps or other technical items found on the wheelchair or on the lifting equipment.

Take your time during the transfer to ensure that the process is under control.

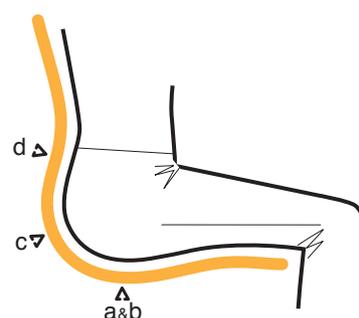
## OTHER PLACES TO SIT

- Consider whether your seating position is sufficiently stable and pressure relieving when you are sitting in a car seat, sofa or armchair. Does the seat surface provide sufficient space for your buttock bones a & b, and is your entire backside being supported? Are your three support points a, b & d located in accordance with drawing 8?
- Avoid sitting in your bed. As a rule, a bed is for lying down. If, for some reason, you need to sit in your bed instead of lying down, make sure that you do so for the shortest amount of time possible. If your wheelchair has been adjusted correctly, it is much safer to stabilise your seating position in a wheelchair than in a bed. In such cases, you should consider using your wheelchair instead. If you decide to sit in bed after all, it is important to make sure that your seating position is stable. If you slide down on the mattresses towards the end of the bed and need to be pulled upwards one or several times a day, your seating position in bed is unacceptable and presents a danger to your bottom. The bases of some nursing beds are split into four parts. By means of an electric function, the base

7)



8)



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automatically adjusts itself to a seating position by including a so-called knee break. If you need to sit in your bed, such a function might be able to protect your bottom. But remember: as a rule, a bed is for lying down!

- Make sure that neither your bottom, nor your bones are able to reach through the mattress to touch the bed base. Have your assistant check this by sliding his or her hand in between your body and the bed whilst you are lying down and/or sitting in bed.

## CLOTHING

- Trousers materials must be flexible and free from back pockets and heavy seams. If necessary, remove the back pockets from your trousers. Think about this when shopping for clothes. Several companies offer good and nice clothes for wheelchair users. Give their products – and yourself – a chance.
- You might be tempted by selecting a wheelchair that will accommodate your winter wardrobe as well by being slightly wider than you are. It is, however, important that your wheelchair fits you perfectly – in the summer as well as in the winter. Therefore, you should look for alternative pieces of winter clothing, which do not require additional wheelchair seat width. Several companies produce this type of alternative winter clothing.
- The cushion cover must be sufficiently large, flexible and moisture transporting. When you are sitting on your cushion, the best thing is for you to be sitting on the original cover. Avoid placing protective materials, sheepskin rugs or disposable materials on top of the cover. This reduces the pressure distributing effect of the cushion, thus doing more harm than good. The same applies if you are sitting in or lying down in your bed. The more layers you are sitting on, and the stiffer

those layers are, the less pressure relieving effect the cushion will have.

- Always use the standard cover and avoid using pillow covers or other inflexible pieces of material as a substitute. Whenever there is a danger of development of tissue damages, the cushion should come with a spare cover. Many cushions come with a special cover that has certain special features, which fit the cushion perfectly. Therefore, it is not a good idea to experiment with alternatives.
- If there is a need to protect the cushion against incontinence, it is often possible to buy special cushions with built-in protection measures. Make sure that the material is sufficiently large and flexible in order to ensure that you are not sitting on a hammock of tight covers.

## YOUR PERSONAL RESPONSIBILITY

Every time you sit down in your wheelchair, it is important that you attempt to visualise and register whether or not you are sitting in a way that provides your body with stability and pressure distribution. For this purpose you might want to get hold of a mirror in order to be able to look at yourself in your seating position from top to toe. This is a good way of checking selected areas of your body each time you get comfortable in your wheelchair. This procedure might assist you in creating a mental picture of the way that you are supposed to be sitting in your wheelchair. Elevating your arms in order to verify whether you are as stable with your arms lifted as with your arms resting on the armrests is also a procedure, which acts as a guideline as to whether or not you have obtained stability and pressure distribution. Learning to read your body signals might require a bit of practice, and the signals might also change over time. Your senses might even play tricks on you as a result of your disease.

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## THE ROLE OF THE ASSISTENT

If you receive support from care assistants visiting you, you need to make sure that they are also aware of the principles of stability and pressure distribution, and that they use the wheelchair appropriately when they assist you in sitting down and when you are already sitting in the wheelchair.

Even though it is not always the same assistant ensuring a good seating position for you, it is still important that you are able to provide those assistants with good guidelines to the largest extent possible. You might want to have your assistants read through this user manual, and you might want to talk to them about the contents of the manual afterwards. In this way, you and your assistants might be able to plan new procedures if necessary. You must remember that you are the only person, who is always involved in those situations.

## THE WHEELCHAIR – AN ASSISTIVE DEVICE THAT ENABLES ACTIVITY

Your wheelchair is typically required to fulfil a whole range of purposes, e.g. being your means of transportation as well as your base for participating in everyday activities. Fulfilling all needs at the same time can be a complicated matter when selecting a wheelchair. Often, you have to prioritise various factors. In such

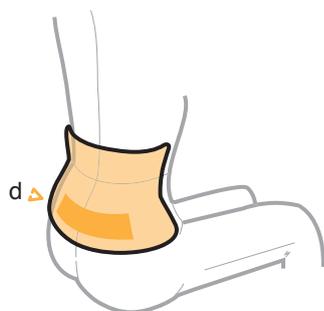
a situation, it is important to be able to prioritise correctly.

The Danish market offers a large selection of wheelchairs. This user manual deals with two types of wheelchairs: manual wheelchairs and wheelchairs allowing for seating position adjustment. Most wheelchairs offer a range of individual adjustment options. Utilising these options is of vital importance. You have to imagine that your body is to be supported by means of the largest possible wheelchair contact area. All wheelchair parts, which come into contact with your body, i.e. your bottom, back, lower arms and feet, must be adjusted individually in order to fit your body. Only then will you be able to achieve the largest possible level of stability and area of pressure distribution. Only paying attention to the features of the cushion is NOT sufficient.

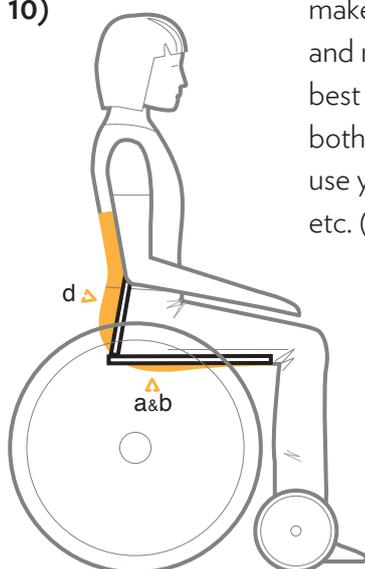
### Manual wheelchairs

A manual wheelchair is either foldable or fitted with a fixed frame. Normally, it is moved manually by means of grip rings (drawing 10). With this type of wheelchair, you would usually not be able to change your seating position by means of the wheelchair functions. If you need to do so, you are better off selecting a comfort wheelchair or an electric wheelchair. Usually, the back padding as well as the seat is adjustable in manual wheelchairs. Utilise these options in order to make the wheelchair fit you and your individual shapes and resources perfectly. In this way, you create the best setting for obtaining a seating position, which is both stable and pressure relieving, even if you need to use your arms to make the wheelchair move forward etc. (drawings 5 & 10).

5)



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Many manual wheelchairs allow the adjustment of the actual seat base to fit the anatomic shape of the user's buttock bones a & b (drawings 6 & 10). By utilising this function, not only will you be able to create a large pressure distribution area within the seat, you will also assist your pelvis in obtaining a stable, neutral position as well as maintain a self-supporting upper body (drawing 10).

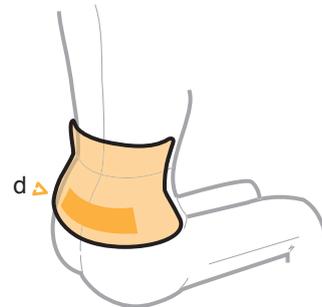
In a manual wheelchair, the support for the 3rd support point d is created by means of the back straps of the wheelchair, which must be particularly tight at this point d. All other straps must allow sufficient space for the upper body, and ideally they must take on the shape of the sides of your body (drawings 5 & 10). If the seat base of your wheelchair is already tightened completely, either the seat straps have not been adjusted to fit your body, or the seat base does not feature this adjustment function at all. In such cases, you would be able to have a strap base fitted onto your wheelchair as an extra.

## When you sit down

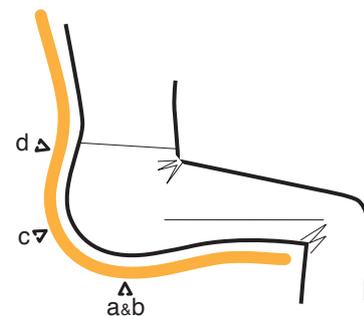
If, as an example, you feel the urge to push your bottom a little bit forward on the seat surface in order to reach a good upper body balance when sitting down, then your wheelchair has not been appropriately adjusted to fit your body. The seat surface below you might have been tightened too much at the back. You must have this issue attended to immediately – especially if you are lacking your sensibility. It might also be that the back padding is restricting the natural curve of your spine because it is too tight either around your lower back or around your upper body. Make sure that both the seat and the back allow plenty of space for your bottom (drawing 8). The wheelchair back must fit the sides of your chest perfectly in order for it to support your upper body crosswise (drawing 5), and at the same time it needs to follow the curve of your spine from the bottom to the top, which you will be able to verify when looking at yourself from the side (drawing 8). You also need to make sure that the one back strap, which is supposed to fixate your 3rd

support point d, has been pulled tight (drawing 5). This area is supposed to provide sufficient stability to your spine in order for it to keep its natural curve and function as a self-supporting construction. Find out whether you have obtained the largest possible support surface on both the seat and the back. You might want to look at yourself in the mirror from the front and the sides, then compare yourself to drawings 5, 8 and 10.

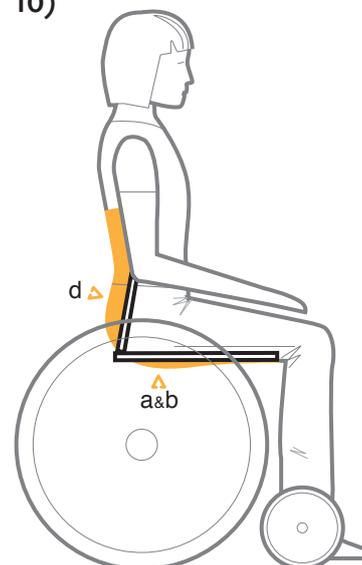
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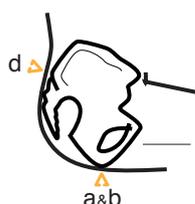
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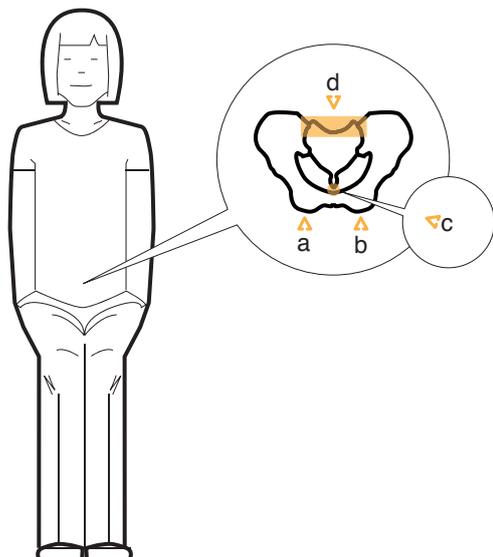
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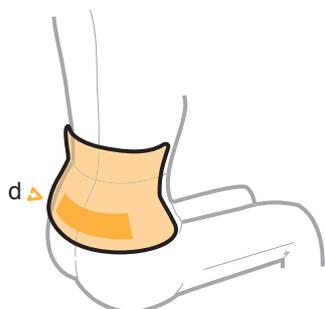
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## When you are sitting

You need to be able to handle the wheelchair without moving around in the seat. Therefore, the seat base and/or cushion must fit the shape, width and depth of your seat surface perfectly. The snug fit of the back padding onto your chest will contribute to a good and stable seating position (drawing 5). The weight of the wheelchair also determines whether or not you are able to remain seated when manoeuvring.

## When you change your position

It is very important that you are able to lift yourself up completely from the seat surface whenever you want to change your seating position. You can either use your arms or, if necessary, a harness. It is very important that you take a realistic look at your ability to elevate yourself from the seat surface and not just carry on with a lifting procedure that you were able to handle when you were younger, stronger and healthier. You also need to consider your current physical abilities in order to avoid the development of pressure sores and deep tissue damages.

## When you drive

You need to be able to drive your wheelchair using as little strength as possible, and the wheels must be placed in a way that allows you to drive the wheelchair with your arms and shoulders in a natural and neutral position. Your shoulder blades must be clear of the back padding in order to allow free arm movements. If your wheelchair is too wide or too heavy, you are at risk of sliding forward on the seat during the drive, and you might put yourself at risk of tissue damages as well (drawing 3).

## Wheelchairs allowing for seating position adjustment

This category includes comfort wheelchair and electric wheelchairs. Although these models typically do not come with back and seat straps like a manual wheelchair does, the seat and the back of a comfort wheelchair or an electric wheelchair still must be able

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to support your body perfectly.

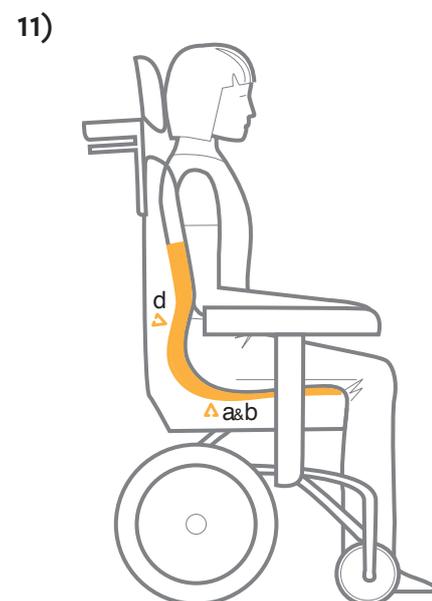
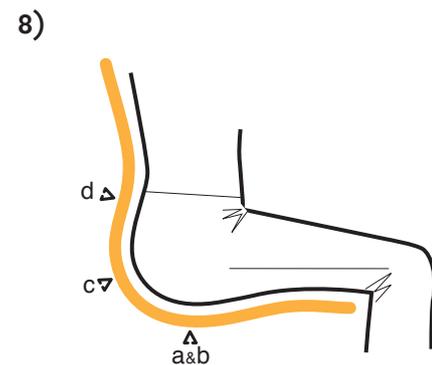
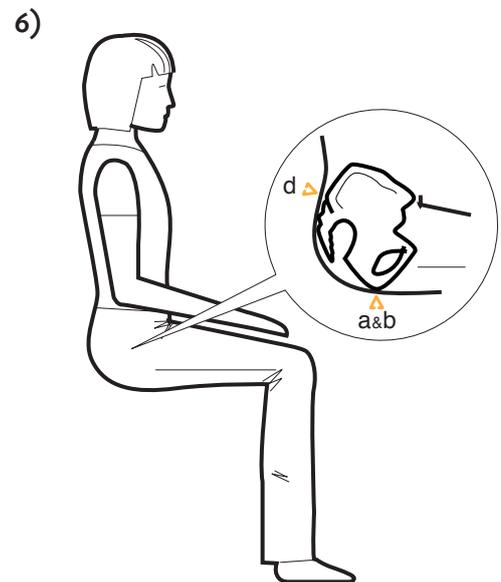
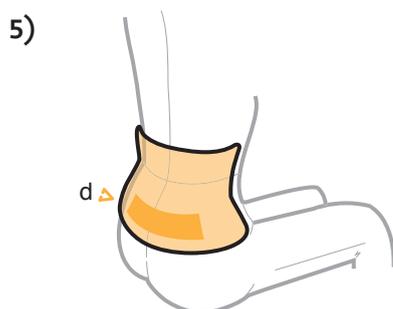
The back padding of the wheelchair must support your 3rd support point d at the connection between your spine and the sacral spine (drawings 1 & 4). In a comfort wheelchair or an electric wheelchair, such support might also be created by placing a pelvic support in the correct area d (drawings 1 & 11).

Unless you are an unusually body-conscious person, it usually requires professional expertise to identify the exact location of the 3rd support point d (drawing 5) within your back and to support it appropriately.

At the moment, comfort wheelchairs and electric wheelchairs do not offer many options when it comes to shaping the seat base to fit your body. Therefore, you will have to compromise. Amongst other things, this will influence your selection of cushion to place on top of the seat base. A cushion for a comfort wheelchair with a fixed seat base must be able to accommodate the anatomical shape of your pelvis (drawing 6). So it needs to allow your buttock bones a & b to sink an additional 3 cm into the cushion material in the back without hitting the seat base (drawings 8 & 11).

## When you sit down

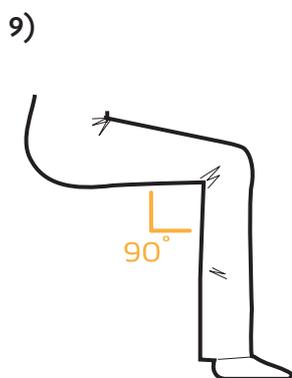
During lifting, you might find it useful to utilise the tilting function (drawing 12) to tilt the wheelchair backwards. If the wheelchair is fitted with a neck support, it is a good idea to remove that during lifting. It is a good idea to leave the leg supports on the wheelchair during the transfer; however, you must make sure that your feet do not get stuck on calf plates, heel straps, calf straps or any other items during the transfer process. It is also important to ensure that your knees are not stretched during the transfer.



## When you are sitting

If you have an electric wheelchair, the control system must be adjusted to fit you, allowing a seating position that relaxes your head, neck, arms, hands and upper body. You obviously need to be able to control your direction of sight in a relaxed manner. If you are using a joystick, the armrest must provide a stable base for your hand and lower arm, allowing you to steer your wheelchair properly whilst resting your arm. In addition, the armrest must function as a pressure distribution area.

It is often possible to fit a variety of foot and leg supports onto an electric wheelchair. Usually, an electric wheelchair is fitted with electric leg supports that might be elevated to a horizontal position. However, such extras jeopardise the maintenance of a stable and pressure relieving seating position. Instead, you might want to use footrests that allow your knees to



be at a 90 degree angle when you are sitting (drawing 9). You can select divided standard leg supports or a central leg support. Depending on your physical and functional needs, and perhaps also on your physical surroundings, you need to select whatever type best meets your needs.

Remember that a wheelchair is an advanced assistive device, which is able to transport you from A to B, and which must allow you to maintain a comfortable seating position. Do not expect your wheelchair to also take on the role as a bed or a piece of gymnastics equipment.

## When you change your position

Comfort wheelchairs and electric wheelchairs are usually equipped with mechanical or electrical adjustment features allowing you or your assistants to change your seating position within the wheelchair. Changing your position regularly is a good idea as it shifts the physical effects of the force of gravity. Most comfort wheelchairs and electric wheelchairs offer two different adjustment options: a tilting function (drawing 12) and a recline function (drawing 13).

### The wheelchair tilt-in-space function

You can use the tilt-in-space function in everyday life when changing your position (drawing 12).

This function tilts both the seat, back, armrests and footrests at the same time. The angle between seat and back – i.e. your hip angle – is maintained during the entire movement. Tilting the wheelchair backwards as far as possible is a really good function. In this way, you are able to adjust the effect of the force of gravity onto your bottom, feet, arms and back without having to change the basic and necessary level of stability.

Under no circumstances, however, should you use the possibility of tilting the wheelchair forward, should this function be available. If you do so, you put yourself at risk of sliding forwards in your seat, which might lead to serious tissue damages as a result of shear (drawing 3). The function of tilting the wheelchair forward must only be used when you want to get up FROM the wheelchair. NEVER use this function to help you sit down in the wheelchair. If the function is available, and you might activate it unintentionally, you might want to have it blocked in order to avoid exceeding the horizontal position unintentionally. In exchange, you will be able to tilt your wheelchair slightly further towards the back.

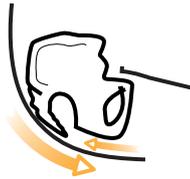
You need to consider, however, whether certain everyday situations in your life require you to sit on a slightly forward tilted wheelchair seat. Perhaps you utilise this function if you are unable to get close

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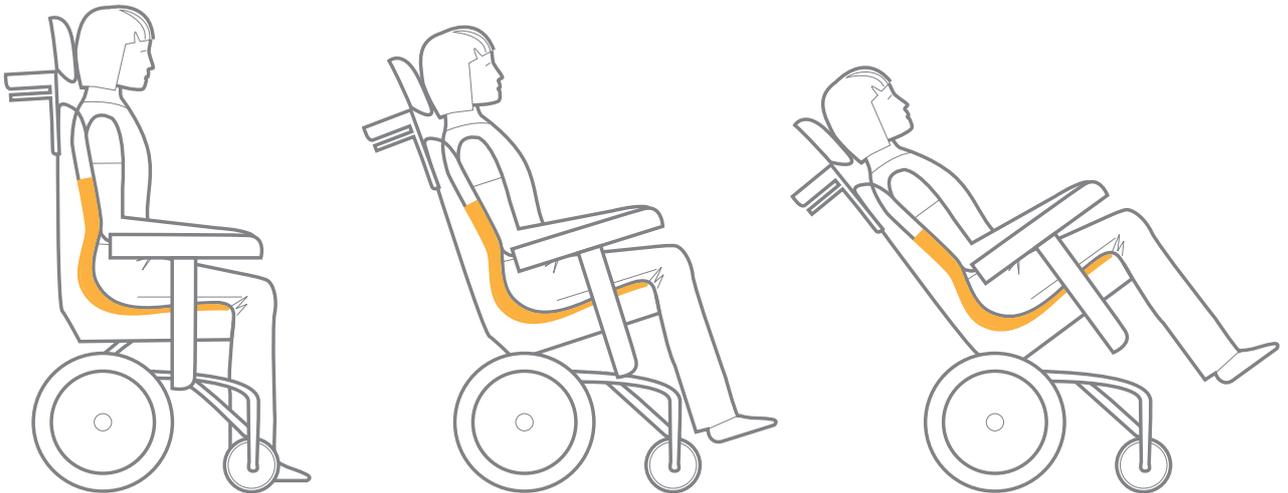
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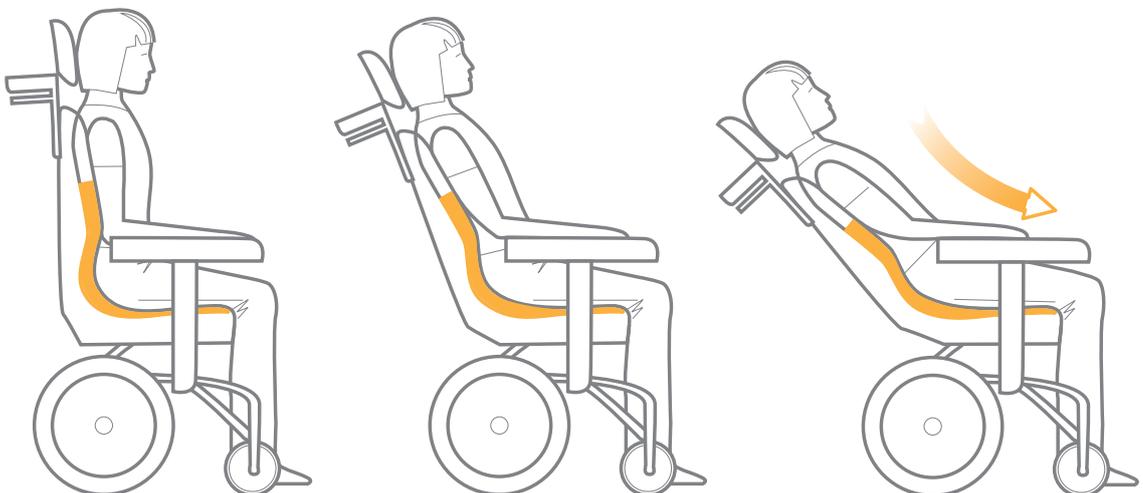
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13)



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enough to your dining table at home. Perhaps you are unable to fit your knees under the steering shaft of your car unless you tilt the wheelchair seat forward. If this is a regular everyday issue, you ought to talk to a therapist in order to look for alternative solutions by altering the surroundings or the wheelchair. If this is only an extraordinary problem, e.g. when visiting people, going to restaurants or doing something unusual and special, you need to look for alternative solutions to such situations, which do not involve the risk of you sliding forward in your seat (drawing 3).

## **The wheelchair recline function**

On the contrary, it is recommended to not use the recline function in everyday life (drawing 13). The recline function offers the possibility of reclining the wheelchair back separately. By doing so, the hip angle is widened. This function should NOT be applied in everyday situations – particularly not if you are suffering from a reduced or completely missing sensibility. Look for other solutions. This function carries a significant risk of developing deep tissue damages when you want to return to a sitting position after having used the recline function to make yourself lie down. The recline function will push you slightly forward on the seat surface. This movement is so subtle that you might not even notice it. It might, however, be sufficient to make you end up sitting on tissue subject to shear (drawing 3).

Therefore, the recline function should only be used in the initial adjustment of the wheelchair to fit you and your body. Afterwards, it is often a good idea to remove or deactivate this function.

If you believe that there are certain everyday situations, which you cannot possibly handle without the use of the recline function, you need to look for alternative solutions to these issues. If you are still convinced that those procedures cannot be altered, you have to minimise the number of reclines that you do. At the same time, you should avoid using the recline function to return yourself to a sitting position.

Amongst other things, this means having to have an assistant manually and very carefully helping you to get up and return to a sitting position without using the recline function. Once you are sitting upright in the correct position, without leaning against the wheelchair back, the recline function may be electrically or manually activated in order to return the back to an upright position. Then you can lean back again. Another way of using the recline function without suffering any damages from doing so might be to use it in connection with the tilting function. This involves returning the recline function from the lying down to the sitting position whilst the wheelchair is still tilted backwards, having the wheelchair tilt you the rest of the way until you are back in a sitting position. However, if at all possible, avoid using this function in everyday life.

## **When you drive**

If you are supposed to drive your comfort wheelchair yourself by means of the drive wheels, these must be placed appropriately in proportion to your arms and shoulders. If they are not, you will feel worn and sore after each drive. You need to make sure that your sitting position is stable and that you do not pull yourself forward in seat during the drive, e.g. in order to maintain your balance. As a rule, a comfort wheelchair is not particularly well-suited for you to drive it yourself by means of drive wheels. It might be a good idea to utilise the wheelchair tilting function and allow the seat to be tilted slightly towards the back during the drive. This also applies when driving an electric wheelchair. In this way, you make sure that you do not slide forward in the seat as a result of bumps and shaking caused by the road conditions (drawing 3).

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A user manual for wheelchair users

By Helle Dreier

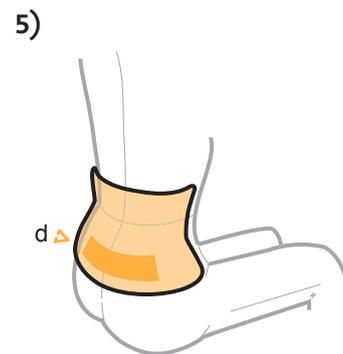
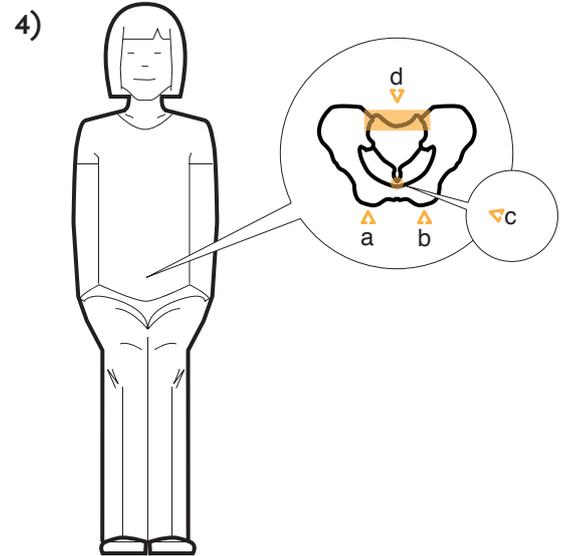
## LOOK AT YOUR BODY

In order to gain an insight into your personal seating position, you want to look at yourself from top to toe in a mirror. This is a useful tool in your attempts to control your sitting options and your seating position, at the same time ensuring that sitting does not cause you any harm.

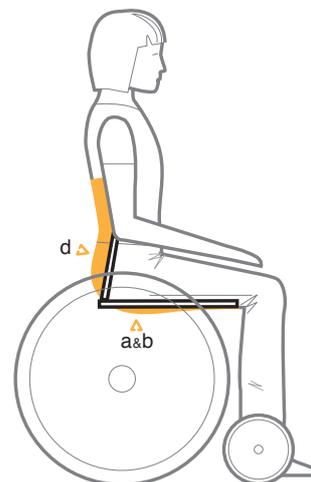
### From the front

Concentrate on relaxing yourself as much as possible, and then look at yourself from the front.

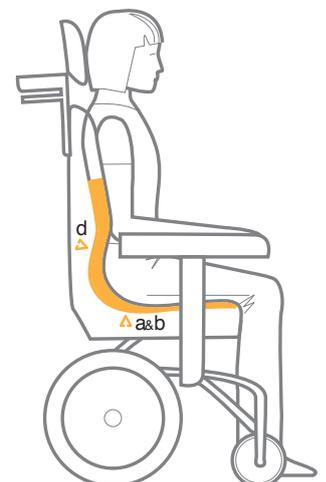
- Do your eyes seem to be in a horizontal position when you are sitting (drawing 4)?
- Are you able to maintain your head and sight in a straight forward position without any problems when you are sitting?
- Do your shoulders seem to be in a horizontal and symmetrical position (drawing 4)?
- Do you have sufficient support for your lower arms from the elbows to the wrists?
- Do your hips seem to be in a horizontal position (drawing 4)?
- Are your thighs parallel or do they seem to fall open to the sides (drawing 4)?
- Are both your knees located at the same height (drawing 4)?
- Are your feet fully supported, feet flat down?
- Does the wheelchair support your chest on the sides, allowing you to sit in a symmetrical and balanced position without any problems, even if you are unable to lean on your arms (drawing 5)? You might want to try elevating your arms in order to find out whether you might be tilting towards one side or forward whilst doing so.



10)



11)



### From the side

Concentrate on relaxing yourself as much as possible, and then look at yourself from the side.

- Is your bottom placed as far towards the wheelchair back as possible (drawings 10 & 11)?

# SITTING COMFORTABLY?

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- Is your bottom allowed sufficient space, or does it hit the back tubes or the back padding, preventing you from utilising the entire seat depth or making you end up sitting on the peak of your buttock bones (drawings 1 & 8)?
- Is your upper body, as well as your spine, resting within the wheelchair back in a stable manner when looking at it from the side (drawings 6 & 11)? Remember that your wheelchair is supposed to function as a substitute for your reduced muscle strength. If your wheelchair does not provide sufficient support, your upper body will typically collapse spontaneously, causing you to slide forward in the seat and “dropping your head” so that you are required to spend a lot of energy making yourself look forward and up (drawing 7).
- Is the 3rd support point at the connection between your spine and your sacral spine secured and sufficiently stable for you to maintain yourself “on top” of the two buttock bones below the buttock a & b (drawings 6 & 11)?
- Is your head balanced at the end of the natural curve of your spine so that you do not need to spend energy keeping it in an upright position against the force of gravity (drawing 6)?
- Are you able to look in the direction that you want to and turn your head the way that you want to in a completely relaxed manner?
- Is the seat angle between your back and your thighs approximately 90 degrees (drawing 8)?
- Is the knee angle between your thighs and your lower legs, as well as the foot angle between your lower legs and your feet, approximately 90 degrees (drawing 9)?
- Are your feet fully supported, feet flat down?
- Slide your hands under your thighs to find out whether the cushion supports your thighs all the way to your knees within the entire depth of the seat. Your bottom must be placed all the way towards the back, and your pelvis must rest against the wheelchair back on the 3rd support point (drawings 8 & 11). You might have to ask your assistant to check. If the seat depth is too long, this might prevent you from reaching the back of the seat. In this case, there will be a space between your bottom and the wheelchair back, making it impossible to obtain the correct support for the 3rd support point (drawing 5).
- Take a look at the drawings (drawings 8, 10 & 11) to find out how the seat and the wheelchair back must be shaped in order to fit your body shape when you are sitting.
- Check whether the wheelchair seat is at least horizontal or – even better – tilted slightly backwards. If your chair is equipped with a forward tilting function, you might unintentionally end up sitting on a slide. It is important to avoid this.

## From above

Put away the mirror and start looking at yourself from the top down, inspecting your upper body, thighs, knees and (perhaps) feet.

It is very important that you think about the signals that your body is sending you. It is also important that you react to any kind of pain and discomfort that might be connected to your seating position. Perhaps you need to seek professional help from a doctor, a nurse or a therapist.

- Do you have the impression that your upper body is placed in a symmetrical position within the wheelchair? How does it feel?
- Do you feel that your upper body is supported, or do you have the feeling that there is still a bit of space on the sides? Perhaps you can feel yourself tilting slightly to one side when elevating your arms? If this is the case, the sides need to be adjusted to fit your body more closely.
- Find out whether you are able to create a more swayed back than your support mechanisms actually allow. You want to obtain good contact between the wheelchair back and your 3rd support point (drawing 5).
- Assess whether or not your knees are the same

length. If not, it might be a good idea to ask a therapist to find out whether the wheelchair could be adjusted to fit you better, or whether or not the transfer procedures might be improved.

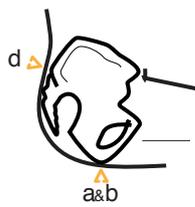
- Try checking whether you slide forward in the seat during the day, or whether you slide forward when you sit down. It might seem that your thighs turn longer during the day, causing them to lose part of the support area of the cushion (drawing 7). Examining your thighs can be a good way of checking whether you might be sliding forward. In this case, you need professional help to solve this issue.
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# SITTING COMFORTABLY?

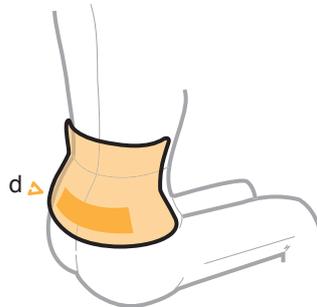
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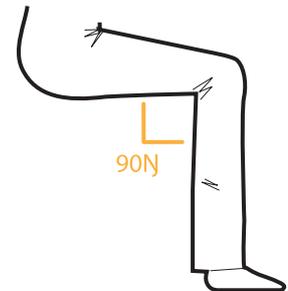
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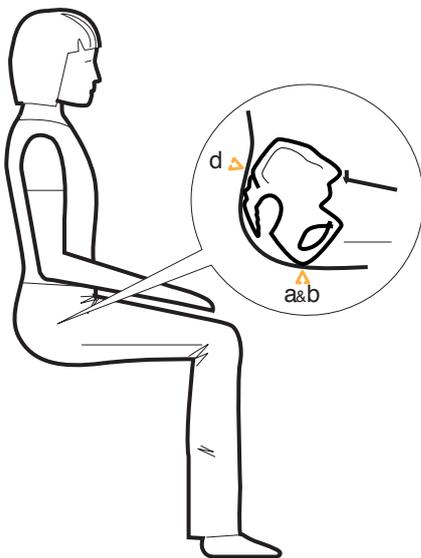
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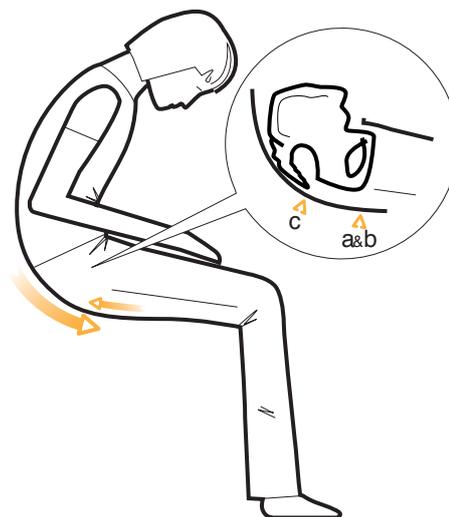
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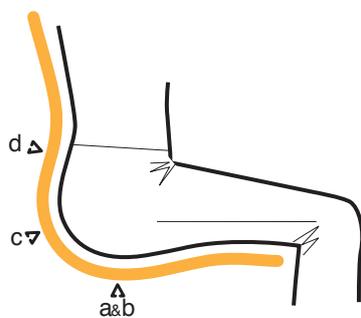
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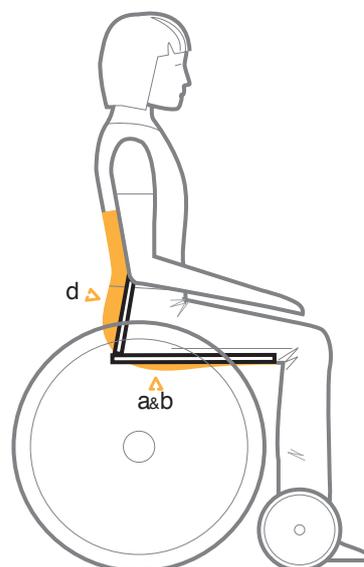
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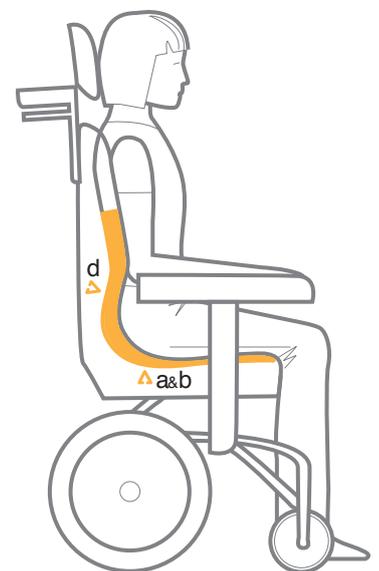
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## REFERENCES

Please refer to the bibliography, which may be downloaded along with this user manual, or visit [www.tryksaar.dk](http://www.tryksaar.dk), which contains a more detailed bibliography.

Finally, please refer to the glossary explaining key words contained in the user manual.

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  - Please also refer to the list of references available at [www.tryksaar.dk](http://www.tryksaar.dk)
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## GLOSSARY

Armrests	On the wheelchair; can be used to distribute up to 10% of the body weight. Must support the arms when the arms are not in use; must not be in the way of you moving your arms and shoulders freely if you are driving your wheelchair by means of grip rings (drawing 11).
Body	Your body must function as a resource of pressure distribution. When the wheelchair seat and back are perfectly fitted to your body, the total amount of pressure on the exposed areas on your buttocks and your tailbone will be reduced. You will want to take advantage of this fact (drawings 5 & 8).
Buttock bones	The two rocker-shaped bones located under the buttocks. Those are the bones that you sit on and which, along with the 3rd support point located on the connection between the spine and the sacral spine, are supposed to make the stable seating position (drawings 1 & 4).
Clothing	Heavy seams on the clothing might add pressure to particularly exposed areas. You might want to remove the back pockets from your trousers or buy clothing designed especially for wheelchair users. The size and thickness of your outdoor clothing must not influence your choice of wheelchair width. You might want to look for outdoor clothing that is not bulky on the sides or on the back. Shoe soles might have different heights, which might influence the extent to which the wheelchair foot rests fit the length of your lower leg. You might want to buy shoes with the same sole height; if not, you will have to adjust the length of the foot rest whenever you change into shoes with a different sole height.

<p>Cushion</p>	<p>An assistive device, which most people associate with pressure sore prevention. Unfortunately, the cushion on its own does not create sufficient pressure relief if the seating position is unstable. Therefore, cushions only make up a small part of the efforts needed to secure pressure sore prevention. The Danish market offers more than 100 different cushions, and your choice of cushion must be based on an analysis of your particular wheelchair, your body as well as your everyday activities.</p>
<p>Everyday activities</p>	<p>Along with stability and pressure distribution, everyday activities is one of the key words within this user manual. Everyday life is full of activities that make good sense to you. Most of these activities can be carried out in a variety of ways, but some of these ways might be risky in terms of developing pressure sores or tissue injuries. One such everyday activity is the transfer from one assistive device to another. Other activities might include cooking, leisure time activities, personal hygiene or work. Think about how you carry out your everyday activities. Perhaps you are able to identify other less risky ways of carrying out those activities.</p>
<p>Foot rests</p>	<p>Used to distribute up to 10% of the body weight. Foot rests allowing the knees to remain at a 90 degree angle provide a better pressure distribution than other types such as elevatable foot rests (drawing 9).</p>
<p>Length of the lower leg</p>	<p>The length from the hollow of the knee to the sole of the foot; it is used to determine whether or not the thighs are utilised appropriately as a pressure distributing area. If the distance is too short, the knees will be elevated from the seat surface, and a high amount of pressure will build up underneath the buttock bones. If the distance is too long, there is a risk of clamping blood vessels and nerves within the hollow of the knee.</p>

Lifting	A process requiring you as well as your assistants to be very careful. Your level of stability and pressure distribution in relation to your seating position depends on the quality of the lifting procedure. You and your assistants might want to practise the lifting procedures together in order to identify the best ones. If, for some reason, the lifting procedure fails, it is better to try again than to adjust the seating position once you are in the seat.
Lifts	Various lifts are available to suit any type of purpose and wish; however, a ceiling lift is usually the most appropriate type of lift in cases involving pressure sores resulting from sitting.
Manual wheelchairs	The type of wheelchair, which is driven by means of grip rings on the wheels. Usually, it is most appropriate for such a wheelchair to be fitted with a strap back, a strap seat, foot rests and arm rests (drawing 10). A light chair is also most appropriate because this typically makes it easier for you to move the wheelchair forward without you sliding forward in the seat.
Pressure distribution	Along with stability and everyday activities, pressure distribution is one of the key words within this user manual. By distributing the body pressure across the largest area possible, we are able to reduce the amount of pressure on those areas, which are usually exposed to a high level of pressure, e.g. buttock bones and the tailbone. The contact surface between the wheelchair seat/back and the back of your body must be as large as possible. Amongst other things, this might be achieved by supporting the natural curve of the spine and by shaping the seat and back padding of the wheelchair crosswise to fit the body (drawings 5, 8 & 10).
Pressure sores	The traditional term for damages resulting from pressure – usually within particularly exposed areas. This user manual only covers damages related to sitting.

Seating assessment	A method of analysing the combination of body, assistive devices and activities in order to make this combination as stable, pressure relieving, non-harmful and meaningful to you as possible. This method requires a specific analysis of your everyday activities within your home, using your current assistive devices based on your specific functional abilities.
Shear	Displacement forces, which might lead to deformation and damage of the tissue located around protruding bones such as buttock bones and the tailbone (drawings 3 & 7).
Skeleton	Your skeleton is the most important resource within your body when it comes to your seating position. You need to utilise your skeleton to stabilise your upper body, and it contains the three support points: the two buttock bones as well as the 3rd support point, which make up the base of your seating position (drawings 4 & 6).
Slings	The fabric, which is supposed to carry the person who is being lifted. Many types of slings are available, and you should test various types at home before making a choice. Usually, you would need to select a sling, which is able to create a position that resembles your final seating position. At the same time, the sling must be as small as possible, and it must be easily removable in order to avoid having to move your body and change your seating position once you have been placed in the wheelchair.
Spine	Your spine must function as a resource with regards to your seating position. You need to use this part of your body to balance your head and your upper body. The natural curve of the spine is supported by means of the shape of the wheelchair. In this way, the spine becomes a self-supporting construction with the ability to prevent gravity from making your upper body collapse. You save energy, at the same time obtaining a high level of stability and pressure distribution (drawings 5 & 6).

<p>Stability</p>	<p>Along with pressure distribution and everyday activities, stability is one of the key words within this user manual. We obtain a stable seating position when we utilise the innate ability of the spine to support itself, at the same time balancing the head and the upper body, by supporting the natural curve of the spine in the correct way (drawing 5).</p>
<p>Tailbone</p>	<p>Is located at the lowest part of the spine and is particularly sensitive towards pressure. (drawing 2). Therefore, it is a good idea not to sit on it. In order to avoid this, you will want to utilise the 3rd support point located at the lower part of the back as the last leg of the stable base needed when sitting (drawing 6).</p>
<p>The 3rd support point</p>	<p>Is an area located on your lower back. It is located where your spine and your sacral spine meet (drawing 5). Locate this area by following the highest point of your hip from your waist towards your back. Along with the two buttock bones inside the buttocks, this area is supposed to make up the stable base of your seating position (drawing 4). Within this area, support from the wheelchair is supposed to allow your spine to function as a self-supporting construction. From this position, the upper body and the head are maintained in a balanced position (drawing 6).</p>
<p>The neutral pelvic position</p>	<p>Involves you sitting on the peak of your rocker-shaped buttock bones (drawing 6). You can only remain in this position as long as your body is supported by the 3rd support point. Think of this position as being similar to a 3-legged milking stool. You can only keep your pelvis in a neutral position by utilising the 3rd support point on your back, located where your spine and your sacral spine meet (drawing 5). If you end up sitting on your tailbone instead, the pelvis is no longer able to stay in a neutral position. Therefore, it will also not be possible to obtain stability in a seating position utilising the tailbone as the 3rd support point (drawing 7).</p>

The wheelchair back	The part of the wheelchair, which is supposed to support the natural curve of the spine in order to create a stable seating position and maintain a balanced head. It must be adjustable by means of straps, or it must otherwise be possible to extend it by means of a pelvic support in the area of the 3rd support point (drawing 10). The wheelchair back can be used to distribute body pressure and remove it from the seat surface (drawing 8).
The wheelchair recline function	A function available on many comfort wheelchairs and electric wheelchairs. The function releases the wheelchair back, allowing the back to recline and the hip angle to be changed (drawing 13). Usually, this function should only be used in connection with the initial adjustment of the wheelchair. Afterwards, you might want to have this function dismantled so that you do not activate it unintentionally.
The wheelchair seat	The part of the wheelchair, which is supposed to match and support the shape of your bottom, at the same time providing sufficient space for the 3 cm of additional depth of your buttock bones compared to the rest of your seat surface (drawings 8 & 10). If you are using a manual wheelchair, it must be equipped with adjustable straps on the wheelchair seat in order to create the largest possible support surface for your bottom.
The wheelchair tilt-in-space function	A function available on many comfort wheelchairs and electric wheelchairs. This function releases the wheelchair seat and back without changing the hip and knee angles (drawing 12). You may use this function as often as you like because it does not alter the stability of your seating position but only the effect of the force of gravity on your body.

Tissue injuries	<p>Although tissue injuries is the same as pressure sores, this might be a more precise description of what pressure sores actually are. In principle, muscle tissue is more sensitive to the combination of pressure and shear than skin. The tissue is much more influenced by pressure and shear when you are sitting than when you are lying down. If the seating position is unstable, and if the pressure distribution is also not optimal, shear will work from the inside and lead to in-depth impacts on the tissue located close to particularly exposed bones. This explains underlying tissue injuries, which suddenly appear on the skin surface after having developed unnoticed over a long period of time.</p>
Transfer	<p>Is another word for moving. Whenever you transfer yourself to your wheelchair and intend to sit there for more than 15 minutes, you need to be careful. The transfer needs to take place in a controlled manner with or without assistive devices, and you must end up sitting on your bottom without having to pull the tissue across the seat surface. A transfer well-done is a big step towards ensuring a healthy seating position.</p>
Transfer devices	<p>There are many types of assistive devices that facilitate a transfer well-done. If you need to use assistive devices to transfer yourself, you need to find the best way to avoid pulling the tissue on your bottom across the seat surface.</p>
Wheelchairs allowing for seating position adjustment	<p>This category includes comfort wheelchairs and electric wheelchairs that allow mechanical or electric seating position adjustments. Usually, they offer tilting or recline functions as well (drawings 11, 12 &amp; 13).</p>