SELLA
PRESSURE RELATED SEATING PRODUCTS

SMS Seating Advice
Step by step

Ter informatie:
Belangrijke stap die uitgevoerd dient te worden
Correct uitgevoerde stap
Een gewijzigd onderdeel in een bestaande meting - Klik op **bewaar wijzigingen** om de aanpassingen op te slaan
Extra informatie die helpt bij het uitvoeren van de metingen
ExtraToelichting over het betreffende onderdeel - Klik op dit icoon om onduidelijkheden te verhelderen
Klik op het **vergrootglas** om een afbeelding of foto te vergroten
Klik op de **printer** om een pagina, afbeelding of rapport te printen

Navigatie:
Gebruik deze knop om **een blad terug te gaan** (rechts onderaan elk blad)
Gebruik deze knop om **nieuwe gegevens op te slaan en naar het volgende blad te gaan** (rechts onderaan elk blad)
Gebruik deze knop op wijzigingen in bestaande metingen op te slaan (rechts onderaan om **al eerder opgeslagen** blad)

Going through the six steps
of the SMS Seating Advice protocol

Overview of the steps within SMS Seating Advice:
Step 1: What is the current state of the posture and pressure distribution?
Step 2: Do the current posture angles match the desired values?
Step 3: Can the posture be adjusted?
Step 4: Is the posture optimal after adjustment?
Step 5: How good is the pressure distribution now?
Step 6: Can the pressure distribution be improved?
Result: The SMS Seating Advice

The steps leading to the SMS Seating Advice

Usually, before the six steps of SMS Seating Advice are followed, choices will have been made for a certain type of wheelchair and a type of sitting posture: a non-adjustable sitting posture or a sitting posture that the user can vary according to different activities. The issues concerned in the choice of wheelchair will not be discussed here.

Step 1: What is the current state of the posture and pressure distribution?

First of all, it is very important to chart the current seating situation and the wheelchair user's sitting behaviour. Also, the client's abilities or incapacity in combination of the characteristics of their lumbar spinal column should be analysed. A number of questions and remarks are important here:

- Is your client's condition due to illness or old age, or is it a congenital condition? Congenital conditions sometimes affect physical and motory development which may lead to greater deviations from the reference postures than one usually sees;
- What is the shape of and how mobile is the lumbar region? In other words, what can and must be the final result of individual support for the back? It is advisable to ensure that an immobile, stiff back is also subjected to loads in a sensible way as otherwise a permanent kyphosing moment on the lumbar spine will arise;
- Is there any sign of impaired perception or impaired functioning of the control system in the brain? If this is the case, the basic sitting posture for the wheelchair should be based on the individually preferred posture in which the head is in balance on the trunk. The average individually preferred posture has a functional backrest inclination, angle (φ+α) of 123°.

Points to note during measurement
During measurement you should continually pay attention to:

- the symmetry of your client's posture;
- the state of your client's clothing: it should not be too tight or be folded double anywhere;
- the manner in which the arms are supported;
- the position of the head: the direction of gaze;
- the adjustment of the footrests;
- the positioning of the pressure mat on the seat.

The recognition and control of these variables is the first requirement for good pressure measurement and for a correct interpretation of the measurement values.
For more information see the documents 'Measurement manual' and 'Determining the symmetry of the sitting posture' on www.pr-sella.nl.

In view of the correct equilibrium of forces, it is important that with every angle (φ+α) the correct angle φ is chosen in order to avoid frictional forces in the seating surface. A comfortable sitting angle or hip angle, angle α for the basic posture lies between 103° and 105°. This results in a seating angle, angle φ of approximately 12°. This is sufficient to prevent frictional forces in the seating surface.
Next, the current posture and pressure distribution should be measured under load. The values of the functional backrest inclination and the seating angle

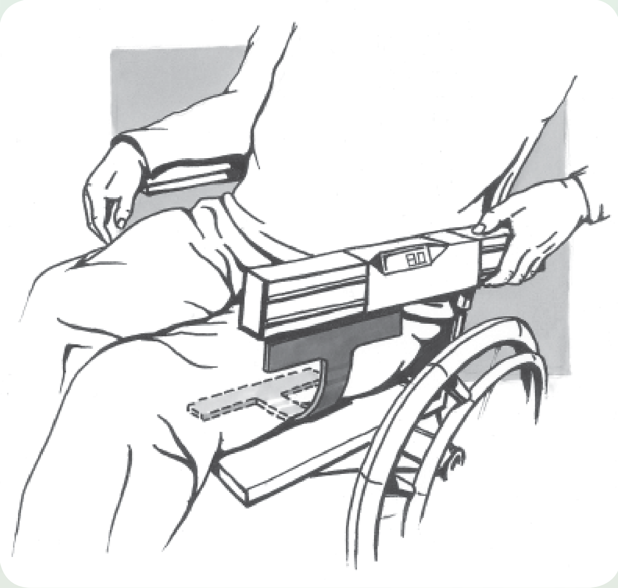


Figure 1: Measuring the seating angle: angle φ

should be measured accurately. Using the measuring aids that have been developed this can be carried out relatively easily and with accuracy.

For determining (a)symmetry and for definitions and methods of measuring, see the manuals on our website. There you will also find more information on the equipment for carrying out measurements. It is also possible to order this equipment on the website.

Lastly, in the analysis of the current situation, you must measure the pressures in the sitting posture. This is done by placing an interface pressure measuring mat directly behind your client's back, and then under their buttocks. The mat (you can use one twice or two at once) should then be connected to your computer and you should log in to the PR Sella website for the analysis. You should wait for 5 to 8 minutes before you freeze and save the dynamic visual representation of the pressure distribution. The pressure sensors need time to stabilize. The SMS analysis software will then reduce the great quantities of data measured to the few representative index ciphers necessary to record and analyse the pressure distributing characteristics of the seat and backrest supports.

Step 2: Do the current posture angles match the desired values?

Optimisation of the sitting posture is aimed at offering the client an anatomically sound stable posture with individual support for the back and a good relation between the sitting angle, angle α and seating angle, angle φ.
The measured values of the posture angles must be compared to the desired values for an anatomically sound sitting posture. Depending on the adjustment possibilities of the wheelchair you can determine how to realise the optimal situation in the wheelchair immediately or how to improvise it temporarily. In this way you can determine whether both you and your client are satisfied with the new situation.

Let it be noted that habit and specific sitting behaviour play an important role in the existing situation and this in turn is often the cause of complaints such as a painful shoulder or problems with the buttocks. Having to change or wishing to change habits and behaviour is difficult: the body and the control system in the brain have, after all, adapted themselves to the existing situation over a long period of time. Wheelchair users do not always immediately experience a new, and objectively seen, better posture as such. The client will have to get used to the new situation and that takes time. It is therefore of the greatest importance to afford first time wheelchair users an anatomically sound and stable posture and individual back support and to inform them of all aspects of good sitting behaviour from the very beginning. This will prevent many problems.

As well as affording a good sitting posture, you must teach your client how to sit down properly in the afforded posture in as far as their capacity allows. Transfer training is especially important. If the tuberosities are not properly positioned in the cushion in relation to the backrest, then this will have direct consequences for the tilt of the pelvis and the extent of the resulting individual support for the back.

Moreover, a pelvis that is tilted too far backwards has a negative effect on the pressure distribution, a fact that became very clear in the first 50 measurement sessions in our pilot project.

Step 3: Can the posture be adjusted?

Adjustment of the posture begins with individual support for the back, the rest then follows.
The reason for this is that individual support for the back has a great influence on the position of the head in relation to the trunk and therefore also on the functioning of the control system in the brain. It also influences the perception of comfort. It is easier to realise that a back that is not individually supported will transmit 'wrong' signals and so have a negative influence on the optimisation process.

Step 4: Is the posture optimal after adjustment?

Once the back has been individually supported, the posture is measured again. The professional can then judge whether the process has produced a functional backrest inclination, angle ($\varphi+\alpha$) that will give this wheelchair user anatomically sound stability.

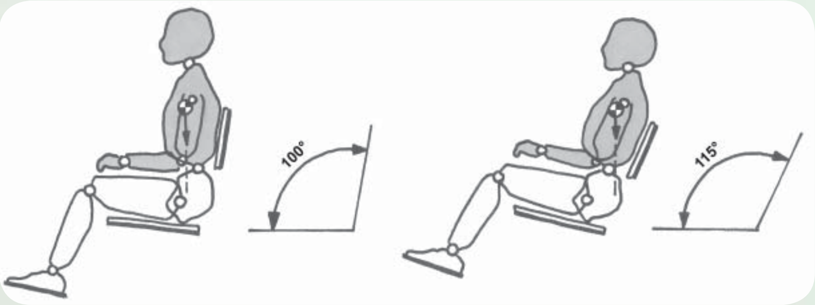


Figure 3: An unstable, therefore active sitting posture and an anatomically sound stable sitting posture with respectively an angle ($\varphi+\alpha$) =100° and an angle ($\varphi+\alpha$) =115°

With the present generation of wheelchairs that afford only one sitting posture, it is a difficult task to realise individual support for the back.
The backrest can often not be positioned above the seat and the backrest is usually flat, without any profile, so that there is little space for the buttocks and the pelvis will nearly always be tilted too far back.
In order to render such a wheelchair suitable for a sitting posture with an anatomically sound stability, one must improvise.
A wedge-shaped cushion is a possible aid for this purpose.
This will facilitate the individual shape of the back and create space for the buttocks.

Figure 2: Wedge-shaped cushion as aid in a conventional wheelchair to create space for the buttocks and to achieve anatomically sound stability.

During this whole procedure of realising the desired posture, it is important to be aware of two aspects that can play a role.

Firstly, you should be aware that the changes of posture can influence the stability of the wheelchair. In wheelchairs with a stability that renders them suitable for doing wheelies this could be too critical. It is easy to measure the stability by placing an angle measuring device on a straight piece of the frame, for instance one of the armrests, and reading the value. In this case, backwards is positive. Then bring the wheelchair with its user into balance on the back wheels and read the value again. The difference between these two values is the stability of the wheelchair. With a stability of 14° it is easy to do a wheelie; with a stability of approximately18° this becomes more difficult.

A second important aspect that one should consider during a fitting is of a completely different nature. When a wheelchair only affords one sitting posture, the general aim is to seat the wheelchair user in an anatomically sound stable sitting posture.

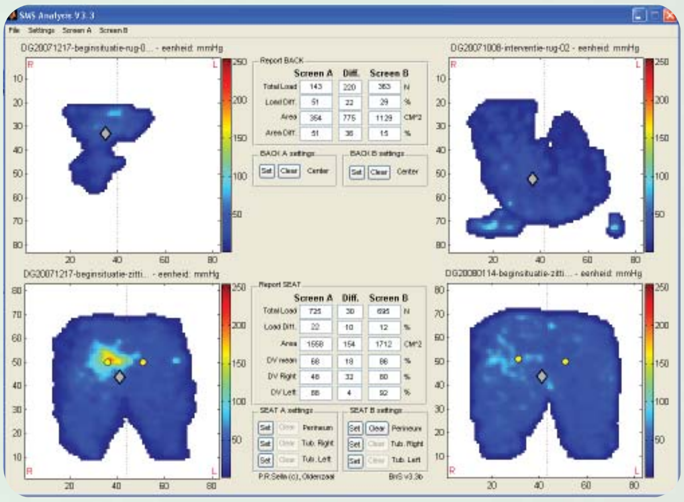
Stability begins with a functional backrest inclination, angle (φ+α) of 115°. That is to say that the stability is critical in this posture.
With a greater backrest inclination the stability will become less critical and the feeling of stability will increase. Moreover, the head will also be more in balance on the trunk and the perception of comfort will be more pronounced. This posture is well suited to watching television or carrying on a conversation, but less suited to having a meal or to handicrafts at the table.

The danger therefore lies in optimising the posture to one in which the user can carry on a conversation as this is what is happening at the time of the fitting. The fact that the wheelchair will only afford one posture means that one must find a compromise for the posture. It is most important to keep this in mind during the fitting.

See our website for more information or to download the Measurement manual.

Step 5: How good is the pressure distribution now?

As was stated earlier, optimisation of the seating support begins with optimisation of the sitting posture to an anatomically sound stable sitting posture.
The sitting posture and manner in which the back is supported determine the position and tilt of the pelvis and the extent to which the natural individual shape of the spinal column is facilitated. The position of the pelvis influences the pressure distribution. The personal pressure distributing capacity of the buttocks is used most efficiently if the shape of the buttocks is maintained as closely as possible under load. In the optimal sitting posture, the coccyx is not put under any (extra) load.
Once the sitting posture has been optimised the pressure distribution is measured once more.



Report BACK

	Screen A	Diff.	Screen B	
Total Load	143	220	363	N
Load Diff.	51	22	29	%
Area	354	775	1129	CM^2
Area Diff.	51	36	15	%

Report SEAT

	Screen A	Diff.	Screen B	
Total Load	725	30	695	N
Load Diff.	22	10	12	%
Area	1558	154	1712	CM^2
DV mean	68	18	86	%
DV Right	48	32	80	%
DV Left	88	4	92	%

Figure 4: Comparison using the SMS Analysis software

The SMS analysis software screen can present two pressure images with their relevant index ciphers side by side. This means that new measurement results can easily be compared with earlier results.
Two situations can arise:

- The result of the pressure distribution is not worse, but better;
- The result of the pressure distribution is worse.

If the result is better, it is necessary to ask oneself if this is enough (for the time being) or if it could be better still. If the result is worse, then analysis is necessary to find the reason for this and to see how this can be resolved with the existing possibilities or using different seating supports.
There should really be an analysis of the pressure distribution in either of these cases to see how the characteristics of the buttocks relate to the properties of the cushion.
Insight into how the pressure distribution is brought about in a cushion is necessary in order to judge the situation properly and to be able to influence it.

Step 6: Can the pressure distribution be improved?

The professional can then test the pressure distributing properties of various different seating and backrest supports for this client. This is done by carrying out a number of seating pressure measurements using the SMS analysis software.

The whole process of optimisation of the sitting posture and seating support is most taxing for someone in rehabilitation because of all the transfers and lifting to place the pressure mats. For this reason it is not possible to try an unlimited number of cushions. Tests with a new cushion should, therefore, be based on a good calculated guess. This is only possible with a lot of knowledge of pressure distributing systems and support constructions and with a lot of practical experience.

General principle

In the analysis and optimisation of pressure distribution, a number of general principles are important:

- a good cushion uses the personal pressure distributing capacity of the buttocks as optimally as possible;
- a good cushion therefore takes on the shape of the buttocks without distorting them. This happens when the forces necessary to distort the cushion are low: the cushion must distort, not the buttocks;
- a good cushion maximises the surface under load;
- a good cushion has a soft, preferably open top layer;
- a stretchable, moisture permeable cover;
- in a good cushion the tuberosities are relieved of extra load by letting the other areas take on more load.

Result: SMS Seating Advice

The completion of the 6 steps leads to the result: the SMS Seating Advice report.

In this report the results of the measurement session are all presented and explained.

You can use the SMS Seating Advice to support your own professional judgement. In this way you can provide your clients with the most adequate seating solutions time and time again.

The list of advantages

1 Improved quality of life for wheelchair users;
2 Objective analysis of sitting posture and seating support;
3 Scientifically supported and product independent selection of seat and backrest supports;
4 Optimal returns from the chosen aids;
5 Transparency in the determination and evaluation of the standard package.

More information

If you have any questions or comments, or if you would like to see a demonstration of the SMS seating advice:
Go to our website www.pr-sella.nl!

For extensive work on sitting and pressure distribution, see the following books:

Staarink, H.A.M. *Zo zit het! Over zitten, stoelen en rolstoelen**, Assen: Van Gorcum. 2007

Asbeck, F.W.A. van (red.). *Handboek dwarslaesie revalidatie*, paragraaf 18.1.1: Biomechanische en (neuro)fysiologische achtergronden van het zitten, tweede herziene druk, Houten: Bohn Stafleu Van Loghum. 2007

*'All there is to know about sitting, sitting behaviour, seats and wheelchairs'.

This English translation is in preperation.