Seating systems for children with special needs

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The best position is the next one!

IGAP
Institute for Innovations in Healthcare
and Applied Nursing Science

children-rehab

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The best position is the next one!

An information brochure

1. Edition

Contents

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Dear Reader,

I would like to address this information brochure especially to those wanting to gain insight into the supply of assistive technology or seating systems for children with special needs. Informing the parents is of particular importance to me here. Choosing the right seating device often is a complex decision for both parents and experts. Many different facets must be considered.

It often is the case that several parties must agree on this issue. Parents do perhaps have another opinion or idea as the doctor or therapist, the supply has to be arranged with the medical store, carried out to anybody's satisfaction, and in most of the cases the costs have to be covered by health insurance.

This handbook shall help all persons involved in the supply of seating systems to better understand this complex subject. Certainly, the basic information does apply also for the supply of other assistive technology (e.g. walking or standing aids).

As the sub title of this brochure "The best position is the next one" indicates, we of the IGAP Institute would also like to see that the idea of dynamic but at the same time stable sitting is considered when supplying children with assistive technology in general and seating systems in particular.

We would like to sharpen your senses to assess which cases require rigid and purely passive sitting, and why it is worth considering other possibilities, as well.

Enjoy reading this brochure. I hope some of the information will be helpful for your continued work with children having special needs.

Director paediatrics of the IGAP Institute

How and when does a child start sitting "normally"? What needs to be done, when this doesn't happen?

As a rule, children are able to sit by themselves between the 9th and the 11th month of life.

This step is crucial for further development possibilities. Only now the children can use their hands to touch, explore, and handle things, having a visual control at the same time.

For the social development being able to sit means that a child can come into contact with other people at eye-level, and thus is no longer viewed passively from above.

This induces the end of the "baby era" and the child becomes, like after many other developmental steps more, an autonomous person.

A special seating system becomes important, when …

1. … straightening up to sit independently happens very late or not at all.

For their mental and fine-motor development children must be able to use their hands rather independently. At the same time they need to see what they do.

A special seating system becomes necessary when children don't straighten up whilst the development in other areas requires an upright position.

This is important not only to play and explore the environment, but also for eating and drinking. Feeding bigger children on the lap is very difficult for the mothers and often bad for their back.

This passive, half-lying position is also not beneficial for the autonomy of the children. Moreover, children with disabilities do often have problems with eating and drinking.

Contrary to a common opinion swallowing problems cannot be improved by taking a half-lying position during eating.

In this way, liquids simply "run into the child's body" and the risk of choking or an aspiration (inhaling the liquid) increases.

If it becomes clear that a child won't be able to sit by themselves in the foreseeable future a special seat becomes necessary.

However, this decision should always be made consulting a doctor and/or therapist, who know the child quite well. (Fig. 1)

2. … the sitting posture remains very instable due to motor difficulties.

Toddlers who are not yet able to **stand or walk** by themselves still have a backward-tilted pelvis when sitting. The centre of mass of the pelvis then lies behind the ischial tuberosities.

In this posture straightening up the spinal column is hardly possible. The back is curved and the head falls forwards or is superextended for **compensation**.

In both cases the eye-hand-coordination is strongly restricted. In addition, the child cannot use their upper limbs for fine motor activities, since they are needed to stabilise and support the posture.

If developing normally the pelvis adapts itself by-and-by. The muscles involved get stronger and allow the child to sit upright. For children with functional motor limitations this process often takes place insufficiently only. (Fig. 2)

Weak trunk muscles, spastic movement patterns or uncontrolled, exaggerated trunk motions may also restrict them in their ability to sit independently.

These restrictions should be balanced in the best possible way by supplying a good seating system.

A good seat thus provides for a better straightening of the pelvis or/and stability in the trunk. (Fig. 3)

(Fig. 1)

(Fig. 2)

(Fig. 3)

The seating system should suit both the child and the situations in the child's life

If taking a closer look at special seating systems it becomes apparent that one very important issue is that the child should sit "nicely" upright and straight. It certainly is important to position the child as symmetrical and upright as possible to prevent possible complications (slanted postures, hip problems, contractures).

However, this upright and straight posture should never go at the expense of the everyday practicability. And it should also not go at the expense of the child's need for being active. It should not restrict the child in their own activities.

Besides providing a good posture to the child it is crucial, too, that the chair suits their everyday life and that it meets all the technical requirements (like seat height, width of the base frame, etc.).

When trying or prescribing a chair one should also consider well for which situations the chair is needed.

- Shall it support activities like eating or playing?
- Or, is it a chair for rather passive moments in which the child should relax?
- Or, should the chair be adaptable to all these situations, and what do I require then?

Harnesses, for example, can be used temporarily only. Many children need an upper body belt only when they are tired and flabby. In very awake phases they manage quite well to keep themselves upright. This all needs to be considered seriously for each individual child.

Important:

Make sure that the equipment/the accessories that you choose allow your child to get along with the chair also when they have weak phases. Always pay attention to what your child needs in the particular situation. ***Sometimes less is more.***

What does muscle activity mean, and what does it have to do with sitting?

Muscle activity is the contraction state of the muscles. Here one can decide between the resting tone and the muscle tone in activity.

To be able to adapt the activity tone to the respective situation or action we need much experience which allows us to adjust ourselves to new situations over and over again.

Significantly reduced tone in the upper body

This, amongst others, is the reason that small children need so many motional and sensational experiences and bodily experiences in general for their development.

When sitting the tone keeps our trunk muscles upright. That means we are constantly working with and against gravity.

This is a problem for many children. Children with neurological problems show the following problems of muscle activity:

a) limp muscles
b) spastic hypertension
c) unintentionally changing tone

a)
In central brain damages (e.g. cerebral palsy) the trunk muscles (mainly the tonic muscles), which normally take over the static work, tend to hypotonic, i.e. to a low basic tension. These muscles are mainly needed to keep the posture, i.e. to straighten up the trunk and to keep it upright against gravity. (s. image)

b)
The phaseal and more dynamic muscles of arms and legs on the other hand often show a too high tone or even spastic movement patterns in these clinical pictures. However, depending on the clinical picture a hyper tone can also be found in other muscle groups.

c)
In clinical pictures with an athetoid component or generally in dystonic relations the muscle activity changes unintentionally. The children barely have control over their own motor functions and show both in their trunk and in their facial muscles unintentional, strongly varying activities. This clinical picture is characterised by exaggerated, uncontrolled movements.

Sitting and fine motor skills

Like with a tree our trunk is the “bole” that gives stability. The branches of a tree can be compared with our arms and hands. They only can develop when the bole is strong and gives support.

Children with a weak, too strong or unintentional muscle activity have big problems in using their hands purposefully. In these cases a good seating system can help them working more precisely with their hands. This means that the seat provides the basis for fine motor possibilities.

A simple strategy of many hypotonic children (having a low muscle activity) is between-heel sitting. This gives them stability and they have their hands free to play. This however has a bad effect on the hip joints and should not be a permanent solution.

An instability in the trunk always influences the motor functions of hands and arms. A child who keeps slumping down with their upper body, because they are not able to build enough tension here, tries automatically to compensate this by increasing the tension in arms and hands. This again restricts very much the possibilities of being active with the hands.

Exactly these circumstances call for stabilising seating devices.

But a seating device which does not leave any freedom of movement can restrict activities to the same degree as too little stability. Arms and shoulders must be able to move freely. When sitting, the children should be able to bend slightly forwards or to the sides with their upper body, so that they can e.g. reach objects on the table.

Sometimes this is the biggest challenge in the supply of seating systems: To juggle the need of stability and movement.

When sitting between the heels the femoral head is rotated out of the hip socket due to the unfavourable position of thighs.

It is important *to find out about the individual needs of every single child.*

How much support does the child really need?

Where does this stability given by the system restrict the child too much?

Which kinds of seating systems are available for children with special needs?

In the children rehab world there are numerous different product types and many different manufacturers and models. Exactly this variety often makes it difficult for parents, doctors, and therapists to decide.

To make matters more, the same product types are named differently on the market.

In the following we would like to differentiate between:

a) Therapy chairs
b) Seat shells (made to measure or moulded)
c) Mobility seat with MiS

a) Therapy chairs

Amongst the seating devices the therapy chairs are the "simplest form". Normally they are available almost completely ready-prepared. Here, ready-prepared means that the parts are not individually produced for a specific child by the medical store, but that they are already available from the manufacturer including accessories. We would like to give very general information here only, since there are so many differently designed therapy chairs available. Therapy chairs are mainly suitable for children who do not suffer from severe deformities of the skeletal apparatus and who are rather able to build a certain degree of stability by themselves. Sometimes the therapy chair is needed because the children cannot manage to sit independently over a longer period. In other cases they are not able to find the centre of their body and tend to bend to one side.

Functions:

Therapy chairs are to be adjusted to the individual body dimensions of the child.

In this way, e.g. the seat depth can be adapted, making the contact surface of the thighs and thus stability is as large as possible. Also other dimensions, such as back height, seat width, lower leg length etc. can be adjusted. This has the advantage that the chairs often grow with the child for several years.

Almost always they offer a large variety of accessories, like lateral trunk supports, headrests, footrests etc. But there are also therapy chairs which are able to straighten and stabilise children without needing any belts or pelottes, because of the shape of the seat or the way of positioning the children (s. images below).

Therapy chair with castors and height adjustment

Therapy chair for abducted, active sitting and for an independent locomotion

The decision about which chair is suitable or what equipment is necessary should be made consulting qualified staff. Moreover, assistive technology in general and also therapy chairs should be tried before making a definitive decision. A photograph in a catalogue will never be able to show how the child may react or how good the parents can handle the product in everyday life.

b) Seat shells (made to measure or moulded)

Seat shells made to measure are seating devices produced individually for one child. As a rule, an aluminium corpus is equipped with foam pieces, which are produced according to the body dimensions and needs of the child. In most cases this is done by a specialised medical store.

These seat shells can then be used on a variety of base frames (indoor-, outdoor-, combi-frames, or wheelchairs) for different purposes.

Functions:

Due to the individual production and the shell-shaped design seat shells do normally give more support than ready-prepared chairs. In most cases they guide and hold the body very closely. In addition they can be equipped with belts, bows, or pelottes. The more severely disabled children may benefit from this. On the other hand these seating systems do also entail some disadvantages. One point is that they don't grow with the child that easily. When the child grows cushion parts need to be reworked, made new or ground away. This cannot be done flexibly and quickly, because the medical store has to do it.

Another point is that the children don't need much self-activity to straighten up in these seating systems. These systems do on the one hand provide much stability, but on the other hand they take away much flexibility. Because of this one should consider seriously how much support is really necessary and how much the child can be mobilised to raise their self potentials. Only this will make sure the child is not "oversupplied".

Seat shell made to measure

Moulded seat shells

The construction of a moulded seat shell with an aluminium corpus and inner cushion is basically the same as of the seat shells made to measure. The significant difference is that the cushion is made after a mould of the child.

This mould is made either with foams or with a vacuum pillow.

Functions:

Due to the direct mould a very close guidance of trunk, pelvis, and legs is achieved. This means the child is kept in this absolutely passive position created by the mould. This system is mainly beneficial when skeletal deformities exist already and a further degeneration shall be stopped, e.g. for scoliosis not supplied with a corset. For other clinical pictures, most notably here the severe athetosis, this very close, surrounding shell may have a calming effect and reduce exaggerated movements.

Moulded seat shell

As with the seat shell made to measure the difficulties or disadvantages of the moulded seat shell are in growing with the child. A growth adaptation is even more complicated here. The shell often needs to be ground away when the child grows. But taking the supply with a moulded seat shell really seriously, this is not serving the purpose, since the mould can easily be falsified in this way.

The choice of the child's clothes becomes more complicated, too, when using a moulded seat shell. If the seat shell is for example being used both indoors and outdoors it is no longer possible to wear conventional coats. It often becomes necessary to purchase special coats for seat shells, which can be closed in the back behind the shell.

Such a complex supply should always be well-considered and compared with other possibilities. The strong stability always involves an immense immobility, too. The risk of developing pressure sores is considerably increased. The self-activity of the children is reduced immensely.

Important is

… to position the child well during moulding. This is the sitting position the child may take more or less permanently in future. A good positioning often takes at least two persons. If the child is very restless, with strong spastics or if the child is athetotic, even more persons may be necessary to hold and give assistance.

Considering the clothes is very important here. Since the shell shall sit very closely to the child and not with a 2 cm / 0,79" space in-between the child should wear neither very thick nor very thin clothes during moulding, but clothes just as thick as the clothes the child would normally wear in daytime.

c) Mobility seat with MiS

Mobility seat with MiS Micro-Stimulation®

The active principle of the Micro-Stimulation systems mainly bases on the theoretical basics of different therapy concepts, such as basal stimulation, the Bobath concept, and kinaesthetics.

Elementary here is the knowledge that humans need to move, regardless of their physical constitution.

MiS systems support and maintain the mobility and thus the perception of the children. This is done by so-called wing suspensions, integrated in a dynamic backrest.

The freedom of movement, required e.g. in the upper body for unrestricted fine-motor activities, is possible here.

At the same time the MiS seat units provide for hold and stability, where required. This means that the backrest is equipped with this flexible system whereas the pelvic and the entire seating area are positioned inflexible.

Functions:

A MiS seat unit or a therapy chair with MiS is ready-prepared by the manufacturer. The seats adapt well to the changing requirements of the child (by growth or development). Different accessories are available to be chosen according the degree of support that the child requires.

On the one hand these seat units are suitable for children who are able to build more self-activity in their trunk by the flexible wing suspensions. On the other hand also children who are less active can benefit from the fact that they do no longer have to sit fastened, without being able to move.

Child in a mobility seat

Important: Although the trunk is supported, movements of the trunk are still possible here, whereas the child is always brought back into the original position.
Another advantage is the breathability of the back. Heavy sweating is avoided. See image above.

The following should be considered when choosing the right seating device

a) Any seating device should be tried before making a decision. The individually produced seat shells are an exemption of course, although they should also be tried with the child before completion.

b) When choosing the degree of support that the child needs, the motto should be: "As much movement as possible and as little passive stability as possible."

c) None of the seating devices is suited to let a child sit in it for hours, without moving. Freedom of movement and, above all, changing positions are absolutely essential for any child. Offering different positions (lying, standing, sitting) is indispensable in everyday life, especially for immobile children.

d) When deciding for a certain chair or seat the environment in which the device shall be used should always be considered. A therapy chair can be just as good as it suits the situation of the child. Important also is to define what the child shall do in this chair.

e) Static, rigid sitting should be chosen only when it is clear that dynamic or rather independent sitting is not possible.

Important: The team involved in the supply consists of child, parents, caregiver/nurse, doctor / therapist, and medical store. All parties involved should agree on the same and mutually follow the targets.

Orthopaedic problems in the supply of seating systems

Orthopaedic problems must be considered for any supply of seating systems, consulting the orthopaedist or paediatrician in charge. They rarely appear separately and are often mutually dependent.

For an easier understanding they should however be viewed separately. These are some possible problems or questions:

Fixed ankle joints (pes equinus):

Pes equinus often are a consequence of a permanent hypertonia in the calf muscles, as it often is the case with spastic movement disorders.

The functional pes equinus normally develops when the child starts to straighten up to stand or walk. Due to the increased activity in the legs the tone in the calves raises and the foot is pulled into the footdrop position. But also children who lie down all of the time can develop a pes equinus. In a contracture the joint cannot be brought back into a neutral position because of a soft tissue change (tendon shortening) or a change in the bones.

In the supply of seating systems the pes equinus is a problem because of the generally missing “root” for stability.

Our feet are the basis for stable sitting. We can notice this when we sit on a chair, then lift our legs and try to keep an upright posture.

Even if in other respects it is told that children should move without shoes as often as possible, this rule cannot always be applied for children with physical disabilities. Therapeutic seat units are either equipped with an adjustable footrest or can be adjusted in height to make sure the children always reach the floor with their feet.

No support surface on the footrest due to the pes equinus

Children tending to pes equinus or with stretched, spastic legs are often not able to bring their feet into a solid, plane stand. Solid shoes and ortheses, possibly in combination with foot straps, can help to improve stability. In such cases it is therefore recommended to wear shoes when sitting in a chair, a shell, or a rehab stroller.

Adducted thighs:

In central movement disorders the adductors, i.e. the inner thigh muscles, tend to a pathologically raised tone (spasticity). This makes the children have interior rotated legs. The children press their legs together very tightly and partly cross them.

Adducted legs with an obvious interior rotation on the left

In some cases this is so bad that swaddling the child is almost impossible. Moreover, the continuous interior pull has a bad effect on the situation of the hips. Dislocations in the hips may lead to hip luxations, since the head of the femur is permanently being pushed out of the socket.

For the sitting position this means that the contact surface becomes smaller and that it is getting more difficult to straighten up the pelvis. Normally you will now try to provide a wider sitting base using an anatomic mould in the sitting area or, if the adduction is very strong, by using an abduction block between the knees.

Important:

Be careful with the abduction block !!!

Unfortunately, the abduction block is often used as a “brake”. That means that it is positioned at the level of the thighs in order to prevent the buttock from sliding forwards.

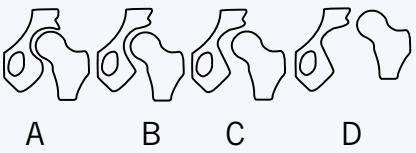
This won’t work!

On the one hand this is very painful (especially for little boys) having a block right in front of the genitals and always pushing against it.

On the other hand there is even more pressure applied to the adductors, which again promotes spasticity.

Conclusion: If using an abduction block make sure to always position it at knee level!

A is a healthy hip;
D is a complete hip luxation



Furthermore, it is important to see whether the children are able to reduce tension in the adductors when sitting with abducted legs. If they don’t, the pressure is increased and the heads of the femurs are pushed out of the sockets even stronger. Another possibility to provide an open, active sitting posture is sitting on a roll or a therapy chair with a similar seat surface.

A posture similar to the one in horse riding provides for a wide and active sitting base which facilitates to straighten pelvis and spinal column. This however requires that the children have a certain degree of motor control.

A backwards (dorsal) tilted pelvis / kyphotic (round) back:

The posture shown below is a very typical one:

The legs are stretched out, the pelvis considerably tilts backwards. This again leads to a strongly bent spinal column. The reasons for this often are weak trunk muscles. The muscles of waist and back are not able to straighten up pelvis and spinal column.

Moreover, the muscles of the rear thighs and the hip flexors intensify the pull of ligaments and sinews. Also healthy people tend to adopt such a passive posture in sitting. If we watch ourselves, most people will recognise that they slip forwards in the chair and bend forwards with the back.

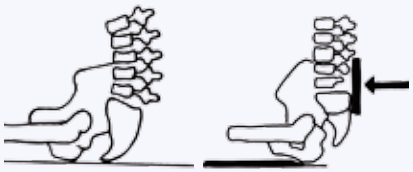
An active seating furniture is helpful here. Sometimes it's already enough making yourself aware about your sitting posture and then tensing the important muscles against it.

Children, who are not able to tense their muscles intentionally and purposefully against this tendency, often need external assistance. The shape of the seating surface or the support of pelvis and back area may be crucial here.

Options
(which can and should be combined with each other):

- abductive sitting or, if possible, saddle sitting, or sitting on a roll
- Seat bone tuberosity padding in the sitting area (deeper cavity at level of the ischial tuberosities) in combination with an iliac crest support, which supports the pelvis
- open hip angle (active sitting)

➤ **a**) without pelvic support ➤ **b**) with pelvic support



Pelvic support

Slanted postures / scolioses:

Slanted postures in the area of the spinal column can be anything from very slight up to seriously, partly fixed scolioses.
(See image on the left)

There are children who simply fall to the side because of a too low innervation of muscles or an impaired perception.

This often is due to perception disorders. If running a hand along the back muscles of these children or by applying punctual pressure to the erector muscles of spine (in terms of the tapping acc. to Bobath) changes in the tone and a better straightening can be achieved. Also stimuli applied to the sides of the trunk can help the children in finding the centre of their body.

This appearance is not yet regarded as a functional slanted posture.

However, these children should be checked carefully in short intervals and stimulated and supported by therapeutic offers or the right seating devices. Very rigid seating devices which do address neither the self-movement nor the perception support are the wrong choice here.

They simply fixate the children, so that the children can hardly improve their own motor abilities.

If children are no more able to actively come out of the slanted posture and thus showing permanently slanted postures or vertebra rotations, this is called scoliosis.

The degree of the scoliosis is analysed by a degree measurement. The following rules of thumbs are used for the therapy, which however can give a rough indication only:

- ***less than 20°:*** *regular physiotherapy*
- ***more than 20°:*** *regular physiotherapy plus a corset*
- ***more than 50°:*** *physiotherapy plus corset until the child is full-grown, then perhaps a stabilising surgery*

These decisions are always up to several factors and must be made individually for every particular case. In any of these cases, regardless of the degree of the scoliosis, the back must be supported using solid materials. If freedom for movement is given in the trunk area the children "abuse" this to bring themselves into the slanted posture.

A superextended neck or poor head control:

Here, one has to distinguish between an active overextension of the spinal column and thus of the neck, too, and the limply falling head.

The reason for the superextended neck is a motor disorder, which makes the back muscles to be tensed too much. When lying down the children bend like a bow. When sitting they bend their head backwards again and again trying to superextend. It is very important here to find positions allowing the children to relax. (s. fig. a)

Special headrests, maybe in combination with belts which stabilise the shoulders, can be helpful, too.

Children, whose head normally keeps falling backwards limply show a too low muscle tone in the entire trunk. The pelvis is tilted backwards, as a consequence the back bends strongly and the head seems to superextend. In fact, the head adapts itself like this to prevent the centre of the child from shifting too much forwards. (s. fig. a)

In these cases it is important to optimise the positioning of pelvis and spinal column. Furthermore it is very important to improve the tone by giving sensor stimuli.

Supporting the self activity of the children should be preferred rather than holding and bedding the head in a passive way.

a) superextended neck

b) poor head control

Dynamic and stability – the best position is the next one

In conclusion I would like to talk about what it means to help children with disabilities or physical limitations sitting as actively and dynamic as possible.

We have seen which orthopaedic problems or problems in general have to be considered to supply the right seating device. The children are being straightened up, kept upright, positioned symmetrically, or supported laterally.

All of these termini have a familiar ring to all those who are actively involved in the supply of assistive technology. It however becomes apparent that all of these terms take a very passive idea of man as a basis.

All of this is done with the children – the question is: What are they actually doing themselves? Are the children being seated, or do we want to help them to seat themselves as good as possible? And, what do they need to be able to do so?

The focus in the consideration of supplying the best possible seating system is normally put in achieving an orthopaedic rather correct, symmetric result, i.e. sitting position. In the best case one may also consider whether this seating furniture fits to the environment and everyday life of the child.

Positioning the child in the seat then often is made according to the principle “to play it safe”. To make sure the child won’t “slip” into any non-physiological positions, they are held at various body areas, supported, and fixed with belts.

But how does it actually feel to be kept in the same sitting position for perhaps 5 hours? I guess that only the fewest of us can answer this question, because we never had to experience this …

Please monitor yourself: How often and for how long during the day do you sit completely physiological, upright, and correctly? Our spinal column and thus that of our children, too, permanently requires little movements and changes in the position to maintain its function. Our muscles need this interplay of tensing and relaxing, too, to work properly.

In office furniture, car seats, or school chairs, this is already discussed and put into practice. Only for the supply of medical assistive technology the main focus still is on static positioning.

Children with special needs surely need to be supported in sitting There is no question that children with special needs often need to be supported in sitting. However, perhaps this must not always be done in a purely static and fixed way …?

It is not my intention to criticise static seating systems in general. Of course there are illnesses or circumstances requiring just these systems. I only would like to see that people care more about how to activate children and which seating devices should be offered allowing them to keep themselves upright independently, and, not least, to make them feel comfortable.

Children with special needs sometimes need more support to tap their full potential

Supplying a proper seating system may create the basis for the best possible autonomy and activity.

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