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## Rehabilitation of the upper limb after an stroke. Part 7. Stabilisation problem.

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## Abstract

**Introduction:** Everywhere in the world is there often an distribution in tasks what the physical therapist do and what the occupational therapist do. The first is responsible for the walking and balance part ( the leg part )and the second is the expert on the rehabilitation of the ADL and IADL and the function of the arm. The trunk /head is an area where they are both be present or .....

That means that the effects that will occur of their training on the whole body are not know by members of the rehabilitation team. An person that is excessive busy with lifting of the arm in an flexion synergy will increase the tone of the neck muscle and that can have influence on the possibilities of the mouth and tongue. But this example is nothing, comparing the effect of the balance training on the tone of the affected arm/hand. Extreme training of r the balance/walking will increase the tone in the affected arm and that will have an great influence on the possibilities of the arm.

It is even possible that the great amount on the training in the beginning on walking and balance will have an great negative impact on the possibilities of the hand/arm function. Regrettable there is little interest and investigation for this topic.

**Design:** To compare the enormous reactions that people in sport must make to react on the all kind of situations to hold control of whole with that what people after an stroke must do to deal with increase difficulties.

We see all that people after an stroke when they stand up, or walk or do other difficult things an increase have of their tone. We see that the affected leg is less fluency but we see also that the arm /hand goes in an associated reaction or even in an increase flexion movement ( maybe) attitude synergy. And after that exercise we see that this tone decrease but always lesser fast. In practice we feel that the function of that arm/hand was decrease after an exercise with an high increase of the tone and it looks like that the further improvement were difficult.

**Conclusion:** Stabilization of the body is very important and play an major role in the treatment of people with an neurological tone change. And it is very important to control that and that science look how this is created and what the best approach is. But our conclusion is that this is an sign that the difficulty is too high and that this person must do something that is too heavy !! .

**Keywords.** Arm-hand rehabilitation, stabilization, associated reactions or movements.



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## Introduction.

Stabilisation is the necessity that there must be an fixated point in the whole body that take care for one firm point for the front and back diagonal. This isn't necessary by normal movements but when people move against the border of their possibilities that we see this phenomena developed.

This is by people after an stroke also the case and often is that the affected upper trunk and arm.

When there is no stabilisation in stand walking or sitting posture[1,2] than there will be an synergy develop in the affected arm that must care for this stabilisation. This we see by "normal" person, even athletes as they perform against the edge of their capacity.

Looking to normal motoric behaviour, we see, that top athletes need to create an stabilisation when they do an power moment, with both legs in the air.

In tennis by the service or by volleyball by an smash. Both legs are of the floor and in the air with one hand a powerful strike is executed.

The other hand must now take care for the stabilisation and the most strange arm postures can be seen and that postures can lead to complaints. Because often the muscle power is so high that joint are turn in the end position with too much force. This moving to the edge of the joint mobility is according the rules of Bernstein [3] to block too much degrees of freedom.

By patients with an stroke can an good arm/hand function of the affected side so be vulnerable or even loss some selectivity. Therefore be aware that the arm need an lot of attention to hold the possibilities on the highest level. That is the message (Therapist) that the treatment must be total.

On the contrary an activity behind an table with the affected hand active with an robotica and the computer, the remaining part of the body search for an perfect stabilization.

Look also under the table.

That is normal but on the affected side can this lead to an increase van tone and that can lead to an loss of stability and has influence on the performance of the affected hand/arm.

The best method to show what stabilisation does for the arm, normally by athletes and by pathology is looking at photo's. My teacher Gerard Worm [4] was one of the first how understand, why Steffi Graf has so often complains about their left thumb /shoulder and that has an simple reason that the stabilisation of her body in the arm ask so much of the shoulder- and thumb joint that this was too much .



**Photo 1**

### **Photo 1.**

Totally in the air, by an return of an ball, what is the best possible muscle pattern to get all focus on the returning of the tennis-ball.

Look to the position of shoulder and especially of the thumb of the left hand.

The diagonals[5,6] -front and back have no end point and the right arm must go with the great possible speed and precision to the ball. And there is than only one keypoint available to give an fixed end of the diagonals and that is the left shoulder. There is here no pathology in the remain part of the arm thus we will see that also in the elbow and in the hand is an creation of an fixed end- position.

In this case the fully extension of the fingers and the end flexion of the distal joint of the thumb with adduction in the main joint of the thumb.

Photo 1 and 2 published with the responsibility and permission of the author by j.v.d.Rakt.



**Photo 2**



**Photo 3**

**Photo 2 and 3.**

Two tennis players at the moment of the service. Then this player jump in the air at that moment and hit the ball. This arm /hand is totally focus on that impact to play the ball on the best possible way. Therefore his whole body system – diagonals – must be take care that this service is at his best.

But through the jump in the air there are no “anchors” left and search his body for that anchor and make it one. What we say by photo 1 . we see also in photo 2 and 3 through the fixation of the upper arm against the chest but specially the fixation further distal in elbow and wrist.

Photo 2 and 3 published with the responsibility and permission of the author by j.v.d.Rakt.

Look under the table by patient after an stroke, that perform difficult performance with their hands or only one hand. Often we see that the knees are together with an increase tone, that the pelvis is rotated to the rear and that the tone of that back diagonal on the affected side is increased.

That means that the movement of the affected arm difficulty will have to get to the front, because the retraction of the scapula will increase. This will look like fatigue , but is an increase of the tone of

the back diagonal all away to the upper trunk of the affected shoulder and when there is an synergy than this will also have an great influence of the arm and hand.



**Photo 3**

**Photo 3**

This lady after an stroke is exercising with an stick that she can managed with both hands and the purpose is that she push this stick with both hands to the front and make in both shoulders an protraction with extension in the elbow.

An action of the front diagonal as agonist and the back diagonal as antagonist.

But the anchor is not present, look under the table and we see that both feet are in the air. The not - affected foot tried with the foot tip make an fixation but that will be only extension. The other leg is moving in an extension synergy and that change the attitude of the lower trunk and initiated the back diagonal, especially the tip of the not-affected foot that will push on the floor and activated the flexion synergy in the affected arm and therefore will this arm not be able to hold the stick and push to the front.

Therefore look under the table !!

Photo 3 published with the responsibility and permission of the author by j.v.d.Rakt.

Thus everyone need an anchor! Is that anchor not available than will the system make one and that can mean that an movement as protraction, extension arm isn't possible anymore!!



**Photo 4**

**Photo 4**

An high jump to get the highest height and are able to smash over or otherwise along the jump block of the opponent.

Again here are two elements that asked for an stabilization of the arm that isn't used.

Thee jump has the body placed in an position that cannot be altered in the air, but the jump was there to get in the best position.

Now the hard smash or the smash with little force but other direction is still possible but for that he need an system that can work as an stabilization - an anchor- and that is the other upper trunk and the other arm.

We see in that arm and strong flexion in the elbow , an adduction not total closed and an firm dorsal flexion in the wrist an closed fist.

Photo 4 published with the responsibility and permission of the author by j.v.d.Rakt.

## **Sport – Tennis / Volleyball**

This amount of force necessary to create the optimal hit but also but the greatest amount of force. That asked for an anchor that makes this function possible.

This occur by everyone when he perform an difficult action in which he has no anchor with the other hand or feet on the floor of wall.

Than the free arm will search for an fixation an create an anchor and the amount of force is greater than much people image.

By patients with an stroke is this also present but because there is also an tone and selectivity difference this will have an greater impact than by patients and person that have an normal tone – selectivity

This is on their highest level with the greatest possible selectivity . Still looking to the photos, below, you see part of movement synergy !

Looking to individuals with an stroke than will there also an stabilisation but we must search for the “WHY”.

Reason 1:

There is not enough support of the lower body and therefore must the action of the not-affected arm/hand be stabilized by the affected arm.

Reason 2:

They action that the not-affected arm of whole body must do is so difficult that there is more stabilisation needed. This can mean that the border of the capacity is reach and that this action is too difficult. We will see than by individuals with an stroke static reaction, the whole spectrum[7,8].

Reason 3: the power that this action ask isn't available and therefore there must be more stabilisation power needed to do this on the best way. That will indicated that the physical therapist must search where the lack of strength or speed is and maybe first with task specific resistance therapy try to change that.

Reason 4: An combination of all three. To little base support, too much asking for selectivity and power and this is an border that will never mean that the exercise isn't right but be aware that you are and the end of the possibilities of the individual.

Is this in an exercise this can be very good but try always to assess what the problem is and make room for an special treatment for that part. But when this happen when the individual do something in the ADL of simple reach to grasp something that this means often that the support base is wrong and that he don't can do something because the stabilisation of the remaining part of the body isn't good. This is very wrong because the intention to move is present but the stabilisation isn't good enough.

And when we observed individuals in an Nursing home than is that often the case and is it not an problem that individual don't want to move but it is impossible for them to move because the support area isn't right.

Reason 5. An action with the paretic hand asked for an good an selective trunk .

When the stabilisation from the other part isn't optimal than will this increase the tone on the affected side and that will have an reaction on the possibilities of the paretic arm/hand.

Great frustration will give this, when the hand isn't capable to do something that was possible in another situation. When this is the case or when the activity of the paretic hand/arm is fast less than mostly lie the reason in an loss of stabilization.

In stand most stroke patient stand mostly on the not-affected leg to control [9] their balance and when they are walking is that amount even bigger [10] and that means that the affected arm often must be use as an extra stabilization and that the function that is present in the paretic arm/hand is less as in an sitting position.

That means not that this position isn't right but that there must be search for an extra stabilization that prevent the tone increase of the affected arm/hand for stabilization.

This can be done by the hands-on approach[11] that can control the tone and give more input that give as an reaction an tone decrease or can start with an tone so normal as possible and can facilitated the patient through the exercise with the highest amount of problem solving and the highest intensity without the brace of loss of selectivity.

But also fatigue will give an increase of tone and an lower selectivity and that isn't wrong.

That change the situation and the problem solving is now of another level.

Especially in the ADL and IADL must this be done with fatigue to get for the patient an goal what he can master and also what he can master when he is tired and hasn't too much control.

But be aware that after that there is somebody or the patient self that take care of the mobility of the arm/hand and the upper trunk.

That there is no mobility loss because through the increase of tone.

### Stabilisation by individuals after an stroke in the ADL

#### Examples :



Photo 5

Photo 6

#### Photo 5 and 6.

Individual with an stroke with the affected side on the left. In the course the physical therapist must do an activity with the individual in this case making an steak with an good glass of white wine. Of course she does the job of poring the wine into the glass with their not-affected side ( be an shame when this wine don't goes in the glass) , but look to other side there is the stabilisation. The poring cannot without that stabilisation and it is therefore useless to ask of here to lay down her affected arm because she will not be able to get all the wine in the glass. Now she is cutting the steak with two hands and we see that the affected hand is fixed against the ribcage and the other hand do the job, but she managed to hold the affected hand in that position and we see also that the therapist looks under the table.

There we see that see cross her legs and with the not-affected leg she pull the affected leg under the chair creating full flexion in the hip and knees and an extension in the lumbar spine with the pelvis in an forward position. This stabilized the trunk and give more possibilities in the arm and hand.

Photo 5 and 6 published with the responsibility and permission of the author by j.v.d.Rakt.



**Photo 7**

**Photo 7.**

Sitting in wheelchair and now participated with an game on an table in front of her. This lady has an severe stroke and can only use her not-affected arm /hand to touch the flowers. We cannot look under the table but the support for the legs are high up and the sitting part is on the back lower than on the front that means that the chair position makes the movement to the front almost impossible and now the stimulus is there to reach to front but is the brace the position of the chair !!!

To get the not-affected hand to the flower of the Active Cue's [12] and participated with other and enjoy is this difficult because the front diagonal isn't in an optimal stabilization to reach to the front. The affected arm makes an lot of retraction as part of the back diagonal and that push-off is great but the tone will fast increase and after 4 or 5 attempts there is no power to continue and here motivation will disappear.

When the chair has an good position and quality with the leg support absent and the feet on the floor the stabilization will be much better and she can continue with this game and make an lot of movements.

The amount on barriers that here are created, make it almost impossible but;

- An sit part give an stable pelvis and is standing horizontal or even somewhat further.
- Leg rest are placed down or better on the floor and give the pelvis also there an optimal stabilisation

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To get with the not affected hand/arm on table and touch the flower, she need to turn the upper trunk in an extension rotation that start with an extension in her not-affected leg because otherwise there is no stabilisation where she can use as an anchor to reach out.

She press with their not-affected leg against the leg rest, push their affected arm in an synergy against the back of the chair to create an anchor that able her to reach out to the flower.

But the amount of power that she need to overcome the bad position of her wheelchair make an increasing of tone and loss of synergy necessary to participated with this game.



**Photo 8**

**Photo 8.**

Four people on an table playing with an ball. There is only one person that can reach far. The two lady's in the front have difficulties through the height of the table and the position so close to the table. But the lady on the left –back cannot participated because the wheelchair push here back in the chair and reaching isn't possible .

The table asked for three person an search for an extra stabilization to move the upper body further to the front to participated with this game. The two lady's on the front must overcome the chair, that is on the back lower and the table that is to high. Their attempt to get an stabilization of the lower trunk is to flex the knees far under the chair. That will move the lumbar spine in more extension and give the upper body more stabilization to reach further on the table.

Regrettable is this not possible for the two lady's and certainly for the lady in the wheelchair.

No stabilization give thus less possibilities.

Stabilization of the trunk to get the best performance is often very difficult because the environment makes thinks difficult. But still the three ladies have strategy to touch the ball but will lose from the lady left on the back. But the lady right on the back, sitting in wheelchair with the leg rest up will have no change because reaching isn't possible far, because of the inhibition through the leg rest of an movement to front. The back diagonals are fully elongated and that makes an action of the front diagonal very difficult.

In nursing homes often the table are so high that the individuals are sitting on shoulder height against the table .



**Photo 9**

**Photo 9.**

Regrettably we are not able to see what is done under the table but we see that his affected arm is in a sling. Often an indication that the arm/shoulder is vulnerable or hurt. And now he must reach to get the ball but how he stabilizes his body, what happens under the table? Are the legs in flexion and is he creating a good stable position or is he hanging against the table edge with his affected shoulder? Photo 9 published with the responsibility and permission of the author by j.v.d.Rakt.



**Photo 10**

**Photo 10.**

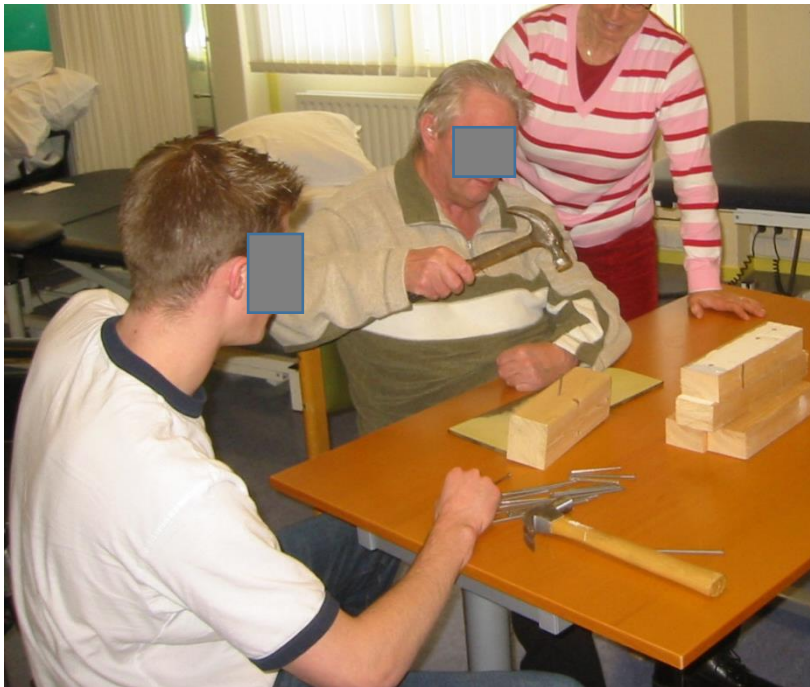
Washing and drying the cups in a standing position. His hand function on the affected side is moderate but he is able to place the cup in a good position in which he is able to dry with his unaffected hand.

But this effect was gone after the washing part and the tone in the affected hand/arm was increased.

Two options: 1. Go further in sitting position or 2. shift the weight more on the affected leg.

The last one was the best now as the tone was less and he was capable of getting the job done. The control of the not-affected leg only increased the tone of the affected hand. But with an extra support on the front this was solved.

Photo 10 published with the responsibility and permission of the author by j.v.d.Rakt.



**Photo 11**

**Photo 11.**

The wish was to try hit an needle in an piece of wood. But the stability was gone after the first hit. He move back to rest against the back - rest of the chair but then he lost the support on the affected elbow. He press with his not-affected foot on the floor to push his body against the back rest and we see that his affected leg goes in an extension synergy. Placing an pillow behind the affected upper trunk decrease this reaction and create an better stabilization. Photo 11 published with the responsibility and permission of the author by j.v.d.Rakt.

Of course is the amount of stabilisation compared with worlds best tennis player is total different but still the rules are equal.

When they are in the air and perform an action with the arm of leg than must there an anchor to control the diagonals.

By the patients after an stroke is that also but because they have often only one leg or arm that can do the fine movement must the other side search and create an stabilization.

An anchor on which the diagonal can fixated and from that point can elongated or shorten and that also in an good coordination from agonist and antagonist.

Photo 9 let us see that the end of the body have an fixation. Both the feet and the elbow give an close chain [13,14] that must stimulated the muscle pattern to get the optimal stability.

But the muscle pattern are too weak to hold the pelvis in an good position and that will give an rotation of the pelvis to the back and this will the patient try to brace by pushing with his not-affected leg because the not-affected arm is no option when than he cannot paint. This pushing with his leg will give extension and the pelvis will rotated further to the back and the whole position loose his stabilization.

Photo 11 give an equal start, also was the base stabilization of the legs and the affected elbow but the huge amount of anteflexion to hit the needle as hard as possible was an reaction that was not expected.

But to get the hammer so high he move with his upper trunk to the back and therefore he needed the action of his not-affected leg for more stabilisation and that give the loss of the stabilisation and the rest against the back rest and the tone increase in the affected arm /hand and the affected leg. ( Flexion movement synergy and in the leg an extension movement synergy )

That the stabilization of the affected side is gone and now he push his trunk against the back rest and has the stabilization to hit the needle.

But the tone in his affected side is huge and he will push himself sideway from the chair and the precision of the hit will fast decrease.

Still an pillow behind the upper trunk create more stabilization and the hit was better possible.



**Photo 11**

**Photo 11.**

Sometimes are wishes of individual after an stroke that he will perform an activity, that seem impossible.

Still it is an ADL performance and for him important and when it succeed than we have an activity (exercise) that will be use often.

He want to use his affected hand to stabilized the piece of paper and so that he can write the letters to his children.

He use till than an extern fixation because the tone of his affected was so high and when he was writing than go the underarm always from the table and that has an influence on his writing performance.

Photo 11 published with the responsibility and permission of the author by j.v.d.Rakt.

To solve this problem the tone that was high in the affected arm and especially the tone of the affected hand must be controlled. Because when the tone increase than was the hand complete closed and move the shoulder in retraction.

Under the table he push than with is not-affected leg and fixated his body against the back-rest.

Solving the problem, could be possible as he has no need for the stabilization from his not-affected leg and that the stabilization was realized somewhere else.

The push with his not-affected leg must be eliminated and replace by another stabilization.

Therefore we choose for an placement with his stomach against the table and he react by placing his fee under the chair. This position gave an position of the pelvis to the front and with the support of the stomach he was able to control his shoulder to the front and stay his hand on one place and he was able to push the arm to the front.

Now he must have something in his hand that fixated the paper because the closed fingers has no good control over the paper .

That must something that was hard to have an inhibition effect on the tone of the hand and was smooth under on the paper and an little pressure must be possible.

This piece must also hard because that had an positive effect on his tone of the hand. We use an PVC -tube that was able the tone to inhibit when he walk.



**Photo 12**

**Photo 12.**

This "Half-Ball" was the solution to create an hand that was capable to fixated the paper and make it possible for him to hold control.

The adaptation was only necessary for the finger top and then was the surface that was set on the paper equal.

The pressure that was necessary wasn't big and he was able to correct the position.

He was very satisfied and this had after an few moment also an positive effect on the tone of the affected arm.

Photo 12 published with the responsibility and permission of the author by j.v.d.Rakt.



**Photo 13**

**Photo 13.**

An example why also in the ADL it is important to assess the stabilization. Because when people are working without an good stabilization than will this have an effect on the affected arm and makes his possibilities lesser.

When this action always go wrong than will this not lead to the activity with the optimal effort to use the affected arm.

Here was the activity of the affected hand to hold the leek in an upright position and the not-affected hand try to cut him in two piece.

Difficult but this was his way of doing and at home he did this with an apparatus, that hold the leek in this upright position and was there no use for his affected arm because at home he couldn't hold the leek on his way because through the tone increase.

Photo 13 published with the responsibility and permission of the author by j.v.d.Rakt.

The therapist has exercise this with him and taught that the dissociation of the affected arm was enough to create an holding that hold the leek in the upright position. Standing in front of the dresser was the problem the stabilization and by pulling him on the affected leg this stabilization was there but at home ?

Therefore was searched of the wall at his affected side or the edge of the dresser can give this stabilization. That was no success and the adaptation was found in combination :

- The stomach against the dresser.
- And an little hole in which the leek had more fixation and now was this possible.

**Walking and stabilization.**

By walking we will see the most associated reactions but this are always stabilisation problems and when that where static reactions with the involvement of the head is that an sign that this form of walking is almost impossible !!

This means that the tone of the affected arm/hand will increase very fast and that tone will decrease after the walking very slow.

This has always two effects;

1. The tone stay high and will have an influence on all tissue. The mobility of all tissues will change and will have an influence on the tone, pain but also on the ADL
2. Often is the walking in the ADL situation something that is to heavy and will be done only when there is no other option, but then will the balance be lesser and will this reaction be stronger and also active by standing up and sitting down.

This group of individuals with an severe stroke has need for an rehabilitation, that continued at home on the same level, but also with search for optimal stabilization on the moment that the ADL must be done in standing position.

Often at the end of the rehabilitation their level is high but very vulnerable.

Often is the ADL on "wheelchair –Level" and that means that the home situation must be changed. Still his capacity to walk and stand and stand-up is need at home but will be lesser at home and in his continue rehabilitation.

There the focus lies on walking in the physical department a few times in the week, but at home is no treatment or exercising to create an higher stabilization and an better ADL at home.

When there is an assessment after 6 months than is conclusion that the balance, walking but also the ADL, IADL, his independency is much lesser.

This means that the caregiver must do more and then it is often an situation that this isn't possible and ended this individual in an nursing home or long care facility.

Treatment of walking and balance must be always have an eye for the tone of the arm and the synergy that there occur.



**Photo 14**

**Photo 14.**

There is an possibility as he get an treatment that help him with the perception deficit and the weight distribution. Very important is the stabilization of the affected leg from foot all away to the hip.

But this walking isn't possible in his home and therefore still an activity in the therapy session.

On this photo we see the tone in the affected hand increase to an Mas of almost 4.

Therefore must this training always end with an tone normalization of the tone in the affected arm.

Photo 14 published with the responsibility and permission of the author by j.v.d.Rakt.

Five year ago, he was going home after an severe stroke and 1 year rehabilitation in an rehabilitation centrum.

Than he was able to walk outside with an stick and the foot was stable. He performance in the ADL and IADL was good but it cost him an great amount of effort to do this every day.

After his resignation of the rehabilitation centre he receive no occupational therapy to continue his ability on the ADL and IADL and he lose his capacity to do it self and must an lot of things do in an sitting position because the stabilisation in stand wasn't possible.

The focus lay on the walking and balance but that was going in an fast tempo worse. Of course the instable foot was an problem but the problem was much larger and that was called –disuse-!

And this disuse was changing in an neglect for the whole affected side and was his performance fast decline and was his staying at home not possible anymore. His caregiver was not able to sustain this and he was move to an long care facilities.

There he did all in an wheelchair and was dependent from others for his basic ADL.

He complaint about his pain in his arm and his fear for walking, stand and also moving in bed.

This last item we have assess.



**Photo 15**

**Photo 15.**

An assessment and treatment to get less tone and pain in the arm and an movement over the affected side.

He was very afraid for this and after 20 minutes he was able to place his not-affected leg on my shoulder. Than the tone decrease in his arm was there and almost immediately was the pain out his shoulder and we say an better foot placement on the affected side.

He never sleep or move in bed on his affected side, but still it was possible and must be the key element of the treatment to get him on an higher level.

Photo 15 published with the responsibility and permission of the author by j.v.d.Rakt.

*Why he wasn't able to get his level after he was come home.*

The focus lay on the walking ability and the ADL and IADL was neglected and especially the influence of the increase of the tone and synergy (flexion movement almost an attitude synergy in the arm and extension movement synergy[7,15], through only walk exercising without tone control has it make necessary that his affected side was going to an lower level. The perception was lesser and that make that his stabilization in the ADL was gone and that will create difficult moments and fear.

Lesson out this casus is again : Severe stroke patients cannot stop with an good treatment but that treatment must be have as an great base on ADL and IADL that people use every day. When there is an problem will the daily positive effect be gone and that will have consequences [16] for other activities as balance and walking.

Regrettably much therapist think that walking and balance treatment can stop this but that isn't true! ADL and IADL are the movement that are necessary and will when people this use every day have the greatest positive effect and of course are walking and balance an part of this but only walking and balance will asked often for an stabilization of the affected side and create more tone and less dissociation and then will there an negative effect on the stabilization of the ADL performances.

And one of the first sign is that some thinks are done in an sitting position instead of an standing position.

After the rehabilitation he did an lot thinks in an standing position but after 3-4 months he must things do in an sitting position and that was the most important sign that there was an loss of ability and that isn't to counter with balance and walking exercise.

Look what is happen by walking and balance exercising and see how necessary it is that the stabilization reaction is controlled but also that balance activity is use in the ADL with an good stabilization .



**Photo 16**

**Photo 17**

**Photo 16 and 17.**

Here we see two elements that we see by people after an stroke;

1. The movement of the not-affected arm especially when the affected leg is in the standing phase to create in the back diagonal enough power to move over that leg.
2. In the affected arm is an flexion synergy present that works as an stabilization and give the not - affected leg an firm anchor, but will increase the tone and make ADL only difficult, when this isn't treat properly.

Photo 16 and 17 published with the responsibility and permission of the author by j.v.d.Rakt.

But what will happen as the tone is increasing and the swing has not the effect of moving over the affected leg. Essential is ADL and IADL what he does in his home. How walking , how he stand and how he makes the best stabilisation.

And of course can he use the affected arm for this stabilization because that will give an close chain.

In the home situation was the stich fast replaced in an 4 feet stick and that means that the push of the not-affected leg wasn't possible any more.

Two remarkable changes were very fast present.

No swing of the affected arm to the front when the not-affected leg goes in the swing phase but an arm that wasn't moving anymore but stay in an flexion attitude synergy.

He wasn't capable to move over his affected hip and therefore he bend his trunk to get an elongation of his buttock and create so an extension moment but not with the movement over his hip.

This lead to an feeling of falling backward and very fast placing of his not-affected foot to the "front".

This lead fear , lesser walking and standing in the ADL. More sitting and his capacity where going downward.

Of course has other reason also an contribution but the main reason was that the treatment was to poor.



Only walking exercises on an high level that he couldn't do in his home. And the loss of balance in standing by the ADL.

It is better that he stand and let someone wash and dress him as sitting and try to do it all on his own. Obvious sitting he has independency but when this ADL standing performance is going the base for much other things is gone and is he his independency in home gone.

And fast after the changing of the stick problems in his shoulder occur as;

- Difficulty with dressing
- Pain

To hold this level in training , it is important that his walking has an lot of variation but more important there is an direct connection with his ADL and support possibilities of his arm.

In other words now the arm is an part of the walking rhythmic, but it is also important that the arm is an anchor for standing activities.

An the best form is that also something he use in his ADL or IADL.

The difference with his home situation and the loss of his training on aspects as supporting and balance and doing some else in standing position, makes that the training of the highest level of walking isn't enough to hold his ability in all situations and that the difference between the treatments and his ADL is far too big.

The level of the severity is difficult to give but when the arm in walking and balance activity isn't moving anymore, every therapist must be see this as an warning system and look /assess again his doing at home.

Two examples.

The first example was an man with an severe stroke that was exercising in an standing up device and complaint about his shoulder.

Second example of an young man with an severe stroke but with an capacity that was almost on the border of bravery. He wasn't afraid of nothing and walk with highest possible speed everywhere and he fall frequently but that wasn't bad.

He was minor traumata but his walking speed and style stay and also his ability to laugh about it and carry on!!

What was the reason for less functioning of the arm and the pain in the shoulder and what say we on the man without fear ?



**Photo 18**

**Photo 18.**

Standing up device in which he use the static reaction ( S.T.N.R. [7], which result in an extension of the neck and arms ( Affected side increase in tone of the scapula) and flexion in the leg ( especially of course in the affected leg) .

He is not capable to stand up on his own but this exercise hurt his shoulder.

His effort to stand up isn't done by his two legs through the static reaction occurrence, thus he asked all he had in his not-affected all extension and that asked for an huge stabilization in the affected shoulder and place the head in an wrong configuration relative to the cave.

Standing up in front of an table with the head in flexion is well possible without the head in end position and increasing of the tone in the affected shoulder and therefore no pain.

Be aware what this devices can do to the possibilities of an individual, not only in his independency, perception but also in the affected shoulder through the need of stabilization.

Photo 18 published with the responsibility and permission of the author by j.v.d.Rakt.

Photo 18 of course also her is the contribution of the not-affected leg to big and asked that leg for an total extension in the whole back diagonal and will this give an ;

- Tone increase in the affected side and in the arm an flexion movement synergy and the start of an flexion attitude synergy.
- This will place the head of the humerus further wrong in the cavity and that can give complaints.
- There is also problems with the circulation and that will worse when the tone increase.

The arm –affected – is needed for an standing up movement in this device but to get this done he must use an static reaction that will make this standing up impossible and will give him also complains of the arm /shoulder and that will increase the tone, influence the mobility and also the selectivity of the arm.



**Photo 19**



**Photo 20**

**Photo 19 and 20 .**

This position of the affected arm show familiarity with the position of the arm by the person on photo 16/17 but there is an very big different, not only what the affected arm does but also in his speed his looking and freedom of walking. Stand phase( affected) with the foot in an not optimal position, there is an swing of the arm to the front prior on the swing of the not-affected leg , that means that the front diagonal is working. But also the swing of the not-affected arm to the back is good , to get the movement over his hip. And standing on his not-affected leg there is an movement of that arm to back bust that reverse when his not-affected leg goes to the front.

In this case is the swing of the affected arm present and is an stabilization of the back diagonal not necessary.

Photo 19 and 20 published with the responsibility and permission of the author by j.v.d.Rakt.

Here we see an man that isn't looking down but walk with an automatism that is unbelievable. But the arm and especially his shoulder could easy do swing exercising with load even in walking but because the hand function was so poor, he don't use his arm .

This is an indication for an robotic or F.E.S. arm to get here more possibilities and then will he use his arm.

He manage with the swing of his affected arm the perfect stabilization.

Stabilisation by individuals with an stroke especially with balance problems is necessary but often gives an increase in tone and when that isn't treat properly, this will end in an affected arm that has pain, has limitations and less possibilities for all kinds of functions .

The alignment that the high tone in the movement synergy makes, can alter the affected arm /hand and also the use of the arm /hand.

Especially in the start of the rehabilitation but certainly when balance is still an problem the affected arm /hand must be treat and every time the treatment is ended this will be an very important job for the therapist. Also must the individual be aware that when the alignment is negative changed, it is very difficult to restore that . Therefore he must at home do his exercise to hold the best mobility and with an normal tone or so normally as possible.

Often in the chronic phase individuals with an stroke has complaints of the upper trunk, shoulder and other part of the arm and then often an assessment gives an picture in which all kind of tissue structure are poor or through the high tone are not well stand.

That has to be prevention because restore is very difficult because it is an projection in the brain and the tissues in the arm has adapt.

## Conclusion

This part has try to get an picture what is possible for the affected hand. The science has created an lot of great things but till now it is laboratory stuff.[11.13.21.22]

To get this available for every stroke patient the devices must be so that people can ware it the whole day. The importance of exercising in the ADL and IADL is often expressed [89,90] but always on cost effect not on recovery level or holding of this level. There are investigation that this level is by much patient and especially the severe one, going downward after the discharge.

The key-element in the treatment must be the focus what he use during the day and that he can do this on an moderate level. When he must work on an extreme level, nobody can hold that the whole day and from the moment that he let go will he lose.

The therapist must have eye on that phenome and beside the treatment always know where the problem can come in the ADL and what he can do to stop that.

That means that at home the therapy is as important as elsewhere.

And that the ADL movement of every day an part must be of the whole treatment.

An treatment of the affected arm is an part of the whole treatment and means;

1. Always see the whole body that react on the high intensity treatment and that there must be always control that the tone and the synergy are not to dominant because that will the brain learn.
2. The treatment of the affected arm/hand must be an treatment to the best dissociation that is possible. Only an flexion attitude or flexion movement synergy is too dependent of the back diagonal starting in the not-affected leg. Balance and walking exercises will create that dominancy.
3. Success in the treatment of the arm must have an translation to the ADL and so that the patient can use it.
4. Mobility , alignment and therefore also tone must be always an treatment issue. To many dissociation don't be exist because of bad mobility and the comment reason for loss of mobility and alignment is the tone.

Therefore prevent this always!!

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