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Rehabilitation of the upper limb after an stroke. Part 3. Dissociation exercise

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Abstract

Introduction

To increase the possibilities of the hemiplegic arm is this the way to get out the synergy and exercises to an higher level. The differences are big, high cortical there is an high representation of the hand but on an lower level isn't that completely changed. Still there are areas in the brain that have an connection with the arm, that we can use to get an optimal result and the best way to integrated the remaining possibilities in the ADL. Still much isn't clear and the answer is still not there what is necessary to get the affected hand –especially- on an higher level.

Design.

Every person is different and that asked for an personal treatment still …

Once an person after an severe stroke say to me:

" Brilliant that I can move and managed my shoulder and elbow and have less difficulties with the ADL and no pain, but at the end of the arm is my hand and that is purpose of all that shoulder movement to bring my affected hand in an position that I can use him ."

I was silent. He was right, I wasn't capable to get an good hand-function. He was able to pick up something and open his hand but only with mass flexion and mass extension . And often when he don't look to his hand was the object gone ! The programme from Yekutil is perfect but he couldn't master the last part because his damage brain wasn't capable to build an good projection that allow him to work with his hand.

Conclusion.

The therapy remain on that level but when stop an while, he experience what he loss in an short time and his motivation was present again .

Still it is never the treatment-goal to hold that level or ….!!

After the treatment of the flexor attitude and movement synergies, now there is more dissociation possible and that can be through recovery but also through an good treatment. But that means don't stop, going on with dissociation, also with the hand to get the highest possible level!!

Keywords. Synergy, arm rehabilitation, chain , dissociation, stroke , diagonals.

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Introduction.

Dissociation exercises.

Dissociation means that we try in the treatment to get more possibilities than the movements that are possible in the flexion and the extension movement synergy. First out the flexion synergy to part of the extension synergy and then increasing the variation in the upper trunk, scapula, gleno-humeral joint all away to the fingers. Exercises in this part will often also possible in the treatment of the movement and attitude synergy but then in another position. Therefore dissociation means that elements of the synergy are decreased and that another movement is incorporated in the movements.

Flexion movement synergy; the stereotype movements are[4,5,6] ;

In the scapula there is ; Elevation, mediorotation and adduction - (retraction).
In the gleno-humeral joint : abduction with exorotation
In the elbow : Flexion and supination
In the wrist; flexion and adduction
In the fingers and thumb : flexion with adduction.

Involvement of the diagonal is the back diagonal or as other say; an lack of power from the front diagonal makes the back diagonal too superior. An increased tone in the back diagonal has an direct reaction on the shoulder girdle all away to the wrist/hand because through the change of the position of the muscles and with the lack on selectivity and the increase tone, give this flexion movement synergy when the patient try to lift his arm.

Extension movement synergy: the stereotype movements are[4,5,6];

In the scapula there is an : Depression , laterorotation and abduction – (protraction)
In the gleno – humeral joint : endorotation with adduction
In the elbow : extension with pronation
In the wrist ; flexion and adduction
Fingers and thumb ; flexion with adduction

To create an extension movement synergy, there must be an front diagonal active on the affected side on the upper trunk part. That front diagonal can be poor but there must be an fixation of the ribcage by the stomach muscle and the pull of the muscle serratus anterior moves the scapula to the front.

Therefore is the extension movement synergy an sign that the damage is less than an flexion movement synergy. This knowledge must be used also for the walking part of the treatment because an stabile pelvis gives the flexor of the hip more stability to functioned. The m.iliospoas need an stabile pelvis and for an stable pelvis the muscle of the stomach, buttock and spine must act together. Than the m. iliospoas has an stable anchor on the inside of the spine and can move the leg to the front.

Differences between the two movements synergy's;

Scapula retraction that is extreme, will be created through an high activity of the not-affected leg that will dominated the whole back diagonal to the affected upper trunk and rotated the upper trunk in an extension rotation and within this an retraction in the scapula [7,8,9].

Restoration of an good movement must therefore start in the lower trunk and in this case also on the not-affected side. In the gleno –humeral joint, we see an "lift" of the arm with abduction and exorotation and in the scapula an retraction and that together will never give an normal lift. Restoration of the lift movement of the arm (anteflexion) is only possible as the scapula makes an protraction.

Regrettably often therapist think that the retraction is an "pathological "movement, but that isn't true because that movement we need when we places our hand behind our back on an bench par example (retroflexion). But the strong present of this retraction as part of the flexion movement synergy makes it impossible to make an anteflexion in the affected shoulder. And again the retraction start on the other side through the back diagonal. That (distal) part placed the spine in an rotation to the not-affected side and the pull on the fascia thoraco-lumbalis stimulated the tone of the remain of the back diagonal to the other side(affected). Be aware that restoration of movement of the diagonals will always start by the good part.

The extension movement synergy has no lift but it is movement often pointed to the ground with adduction and endorotation. This is caused by the front diagonal and the scapula movement that placed

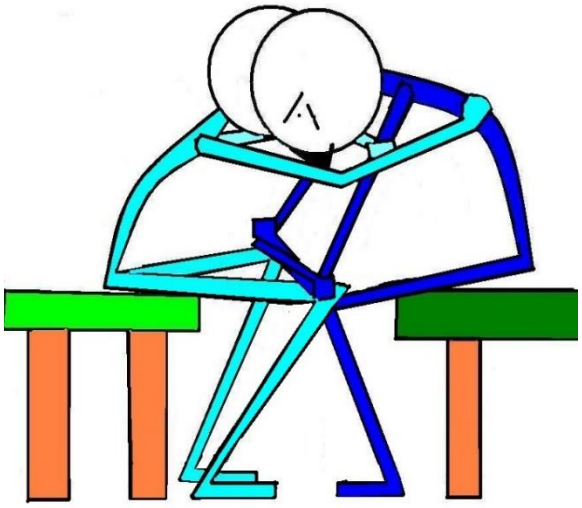
the joint in this position but in the synergy more muscle act as part of the front diagonal . There is less selectivity and therefore the action isn't separated but more altogether, move the shoulder in protaction and that included in the synergy - the m. pectorali (adduction-component)
Synergy means therefore that all muscle do an contribution an create an movement of the scapula in one stereotype direction. Stereotype means always the same and when only that movements are exercises this will be the projection that is present in the brain without an dissociation[10,11]. There are investigation that believe that this process can change in an better form of selectivity[12], but that is only true for the acute stage in which spontaneously recovery is present. There is an projection in the brain that recover but when the projection is to damaged that there must be another projection be created and that asked for an lot of dissociation to brace the stereotype movement.
The elbow movement in the synergy are opposite, in the flexion movement synergy there is flexion with supination and in the extension movement synergy there is extension with pronation. Often this are movements of which therapist concluded that this is an flexion or an extension movement but that isn't totally true. Through the scapula movement there is change in the gleno-humeral joint/muscles possibilities and therefore the elbow must follow. An change in the scapula thus will immediately give an change in the gleno –humeral joint/muscle and also in the elbow[13].
Equal movements in both synergies **;**
In the wrist and fingers the movements are equal and that means that here there is dominancy from the flexor of the wrist and fingers and that there is an cortical system necessary to changed that.
But when there is, what extension in the fingers than is that most often in the extension movement synergy. And that gives again more prove that extension movement synergy has an "higher" brain projection than flexion movement synergy.
Have we an extension in the fingers than must an dissociation in the two movement synergy be possible or there is an restriction in one of the joints that prevent the normal movement.
The flexion of the hand is often an sign of an association reaction[6]. Often the object in the hand can be hold but when it "hurts" or is to heavy, the object will go out of the hand and with "pain" the hand will extend.
This stimulus is so great that this evokes this reaction!
"Pain" can thus be the stimulus to created extension but then must the individual with an stroke be capable to makes this movement more times after each other. Otherwise, when it is only one time, than it is an reflex and that is very low in the brain , maybe not in the brain at all. The feeling of "pain" is clear an sign that this stimulus is enter the brain and that this stimulus gives an reaction starting in the brain.
The VIN – (Very Intensive Neurorehabilitation) program has shown that stimulus with an great impact enter the damaged brain and give an reaction on which this approach try to restore consciousness and it is therefore an way of working that seek the borders to stimulated the damaged brain by enter it [14,15,16]. The upper trunk must be capable to activated the front diagonal and placed the gleno-humeral in good position and we go to train on support with weight of the body with the gleno humeral joint in adduction but also with exorotation and extension in the elbow. Support because now we created an closed chain and is it possible of give an task specific resistance treatment that will increase the power and the coordination and we try to incorporate this in the ADL to stimulated the individual to use this and use it in difference situations, different positions and with different object. We have than variation and stimulated the brain to search for solutions. Differential learning[17,18] .
Support exercises .
The best position is sit on an bench that isn't too high. An good support of both feet is important. The feet on the ground are the base of the diagonal and the chain. I personally always put my legs against the outside of the legs of the individual, on this way I/you can feel or the position is good in the middle and that there is no pressure on the unaffected side because that can stimulated the back diagonal on the affected side. When the pattern in the arm are of an extreme flexion movement synergy, still will an support on the elbow be possible.
Start with an upper trunk flexion and first placed the not-affected side on your knee and ask for an push on your leg because now the tone of the stomach will increase and that can have an decreasing effect on the tone of the back diagonal – reciprocal inhibition[19]. This push will give an action in the front

diagonal and that we feel because our legs stand against the leg of the individual with an stroke. When we push against the shoulder backward we feel the legs go in the hip in flexion or not. When the go in flexion the diagonal of that leg and on the other side the arm are functioning[8].
After an few time firm pushing ask to hold this position with no push and placed the affected elbow on your other knee and ask for an pressure on that spot.
Than both and make of this closed chain an dynamic closed chain and try to change the base and the base position in to going to standing position with support staying on the elbow and later on the hand . Again first in closed chain position than with movement of the support object to the front.

Photo 1

Photo 1.
An inhibition of the trunk before the support exercise is starting. Sitting on an bench with good support ask the individual with both arm between his legs go to the ground. This movement must start out the upper trunk, because we need flexion in the upper trunk and the pressure that is giving on the scapula is to get the tone that cause the retraction, lower. Often there is more difference between the two sides. But it isn't so that this inhibition must be perfect before starting the exercise of active supporting. On the contrary, start first with active support, then inhibition and make support active again. This am elongation with an passive stretch and that inhibit lesser as an active contraction of the antagonist.
Photo 1 published with the responsibility and permission of the author by i.v.d.Rakt.

This attitude on photo 1, many individuals will never come so far but when the comes so far and start with support- training on the floor. Support on the floor will make this stretch on the muscle that has an high tone, not only an stretch but also an activity of the front diagonals and therefore an reciprocal inhibition.
Of course when people have not this mobility than place an crutch in front because only stretch is only an inhibition that is passive. Through the support activity and certainly when we are capable to get task specific resistance exercises in it, than this exercises are an active inhibition and are building on an better coordination.



Picture 1

Picture 1.
The start position with support on the knees of the therapist. The knee of the therapist stand on the outside of the knee of the individual.
The hand of the therapist can go to the upper trunk when the support on the knee is firm and hold the upper affected arm under control and stimulate the upper trunk to flex and pull the scapula to an protraction. This pull will activated the front diagonal on both side and that will stimulated the affected side. The other hand can stabilize the affected arm and stimulated the upper trunk to hold an optimal flexion. This can be done by placing the elbow against the upper trunk on the front.
Picture 1 published with the responsibility and permission of the author by j.v.d.Rakt.

Stretch by hyper tone muscle will only have an reaction when the muscle is hold for an time (minimal one minute) because than the muscle spindle tone will decrease. This stretch will never give an elongation that is enough for an sarcomere reaction, only tone. This is therefore only an tone decrease treatment . When the length of the sarcomeres isn't normal than there must chose for another way to reach the normal length[20]. But the decrease in tone will also decrease the reciprocal inhibition and make the activity of the antagonist better possible and that create an new and better balance between agonist and antagonist and can be the start for an better coordination. The last time there are investigations that give an positive effect on an tone decrease by using the shockwave apparatus[21].

Photo 2

Photo2.
Shockwave treatment on the underarm muscle with the reaction of an decreasing of the muscle tone on that size.
This is investigated by children with abnormal tone and compared with BOTOX treatment and the result was even good as it goes with goal-tone decrease.
By adults the first attempt were done and there were the result equal. There are now trial by Parkinson and dementia.
Photo 2 published with the responsibility and permission of the author by j.v.d.Rakt.

But tonus decrease isn't enough, we need action in the other muscle pattern:
We ask for an push and we feel on the stomach or there is an increase in tone. When that is the case, place your hand on the upper arm and pull this to you and ask the individual to hold the arm in the same position. This pull or you can even push the upper arm to the individual body will stimulated the front diagonal to work harder.
This is therefore an task specific resistance exercise and we can calculated how much R.M. there is and do 3 session of 10 in which we by 8 feel that the resistance is less. That is muscle fatigue and we feel that again when we give an little rest and can do than another 10 and after an short rest the last one.

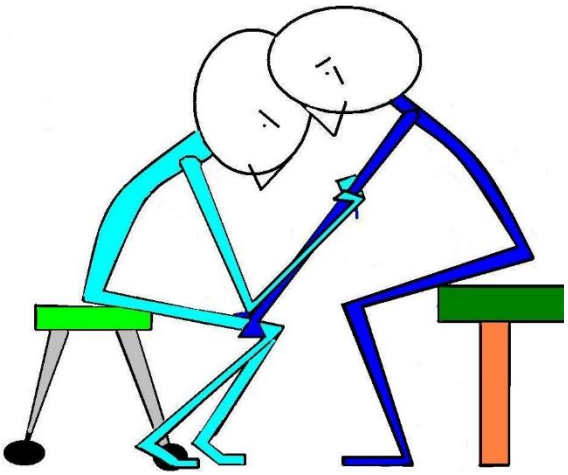
That three times an week with always 50-75%, thus with increasing intensity, will give an strength increase but for all an coordination increase in the front diagonal, stomach and the scapula protractors muscles.
There is not only an 1 R.M. calculation [22] but also an 10 R.M. calculation[23]
And there is develop by T. and E. van de Goolberg the ; The Strength rehabilitation system

Table 1. (SRS - Dutch KRS [24,25])

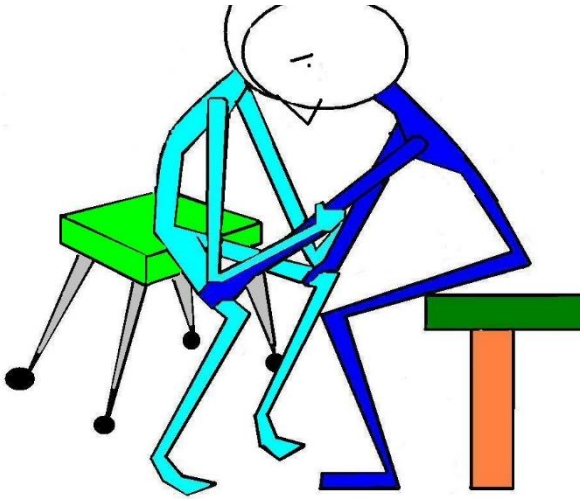
S R S	Coordination	Strength endurance			Hypertrophic	Recruiting in Weight (Kg)			Recruiting in time	
	1	2	3	4	5	6	7	8	9	10
Serie 1RH/ %	15 50%	15 50%	15 50%	15 50%	10 60%	5 70%	5 75%	5 80%	5 50%	5 50%
1-2							-5%	-----		
3-4						5%	-----	+5%		-5%
5-7					-10%	-----	+5%		-5%	-----
8-12				-10%	----------	+5%			-----	+5%
13-20	15 RH		- 10%	-----	+10%				+5%	
21-30		-10%	-----	+10%						
31-40		-----	+10%							
>40		+10%								
Extra RH	No	+3	+3	+3	+2	+1	+1	+1	+1	+1
Pause	< 30"	30 "	1´	1´	1,5-2´	2´-3´	2´-3´	3´-5´	2´-3´	2´-3´

- RH = rehearsal Further information see in the reference list and in the literature.

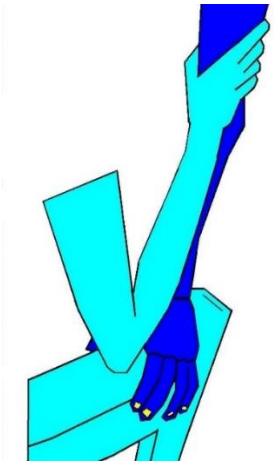
The most important issue here is that this task specific exercise must be given with resistance/ load or otherwise be difficult, because there must be an stimulus to the muscle and along the nerves to the brain to solve this problem and the muscle system must be fatigue . The position on picture 1 will change when there is an force on it, that is progressive increasing according good exercise regime.
From this position we can start to move , make the closed chain dynamic. We can move to the front but also to the side . To the not-affected side ask for more elongation of the affected side more protraction length on the affected side and on the unaffected side less protraction but still no retraction. Be aware that when there is no pressure on the knee this can also be also an action eccentric from the back diagonal and when we now move to the un- affected side and especially to the affected side there must be pressure otherwise the back diagonal can be too active. The second result must be an better extension in the elbow and an decrease of tone in the hand , that makes it possible to place the hand on the upper leg of the therapist and when that goes well , we change the knee of the therapist for the side of an chair or….



Picture 2



Picture 3



Picture 4

Picture 2, 3 and 4.
The support exercise with straight elbow and the hand on the upper leg of the therapist. We have active protraction with exorotation and extension/ part supination in the elbow and flexion in the wrist but more extension in the fingers and thumb with abduction. Therefore an dissociation of both the movement synergy in which both elements must work together. This will be changed in an task-specific resistance treatment and the first variation is from an closed chain going first to an dynamic closed chain to the front and then to the unaffected side and the affected side. Use the technique of picture 4, you can perfect place but also push and pull to make the resistance on the right level 1. R.M. - 75%.
Picture 2,3 and 4 published with the responsibility and permission of the author by j.v.d.Rakt.

To get this damaged brain learning, than there must be giving input that enter the brain and try to get an better coordination. This will be not there after an month, certainly when the brain must re-make an projection that is robust damaged. Opening all variation seem the best potion; “Variation in the Rehearsal” but that this need time to get results. But sometimes there is an reaction and then it is important to exercise in the same position but on another , higher, level of coordination. That can with resistance, but also with relaxation. The affected side we can always support and ask the individual to hold the extension in the elbow but with the other hand on the stomach, we asked for an release of the tone in the front diagonal and make an passive retraction on the affected and after that an restoration of the active protraction with activity of the stomach. But only with the affected arm, that means that the support has than only 3 closed chain instead of 6 when it is done with both hands. And there is by the passive retraction an losing of the tone of the protraction muscle together with the front diagonal and after that an concentric contraction. And when than go to an maximal on pushing, there must be an reaction of the lower part of the diagonals and that we see on the different position of the feet . That we can change by going to another attitude, the exercise has still his priority in dissociation and extension elbow but the base of the diagonal (the feet) is altered:
We change the height of the bench and the feet no longer support on the floor and when the push is good and equal, the knee will lift up and the difference between the not-affected side and the affected side gives use an impression how far the front diagonal is restore and what difference there is between the two diagonal on the front.
Thus three possibilities to make things difficult ;

- Differentiation in the upper trunk, hold flexion but let the protraction free in all different ways.

- And make the push so big that the whole front must react equal and see or the front diagonal is restore and also possible against resistance or with load.
- But also make an upper trunk backwards with an good protraction or even let the protraction go and do an passive retraction with an protraction and make that changes fast and heavy.

This are all signs of an better coordination and more power in the system and will the system help to get control about the synergy and brake this down[10,11,26].

Photo 3

Photo 3.
Working on more selectivity of the scapula movement. Only an protraction of the scapula with an trunk that is quiet.
That means that the tone of the stomach muscle stay on the same level and that the m. seratus anterior increase his tone and make an concentric contraction. This ask for an higher subcortical – cortical control over the muscle. By give an slight resistance to the sternum this can be facilitated or learned. This is asking for an higher coordination level done with an fast normal tone and is often the other border of the performance. Look at his position of the hand/wrist/fingers .there seem to be an increase in toneAn sign that this is difficult!!
Photo 3 published with the responsibility and permission of the author by j.v.d.Rakt.

Changes of position- standing and after that from sit to stand with support pressure.
First exercise in standing position because than is the chain closed, when we go from an sitting position to an standing position than this movement is difficult to hold the pressure on the hand/arm and the chain is somewhat dynamic. Often is it better to hold the standing position and then first exercise the movement back to sit and later from sit to stand. Support exercise need an wrist and hand /fingers, that are mobile.
In photo 4 the individual is capable to placed his hand almost flat on the surface of the chair but often this is not the case. Therefore look for an chair with an side rest on which the hand can be placed with fingers in flexion. In standing position support training start with an lot of flexion of the upper trunk because it is than easy to control the protraction but be aware that this can also elongated the whole nerve system (Slump) [27,28]. This can be hurting and will than make this attitude impossible, but on the other hand when it isn't painful it give an opportunity to "slide" the nerve system an little bit [27].

Photo 4

Photo 4.
Almost perfect support to the front but still there is more weight on the not-affected side than on the affected side .
When we now asked to lift his not-affected leg were will be the greatest support in which closed chain ? The most dominant chain is that chain that has closed ends. That means the not-affected arm and the affected leg, not the affected arm of course, there is an closed chain between the arm but the not-affected arm has the most weight. To get the affected arm in an dominant closed chain you can ask to lift the affected leg but the then goes the weight to the not-affected leg.
Photo 4 published with the responsibility and permission of the author by j.v.d.Rakt.

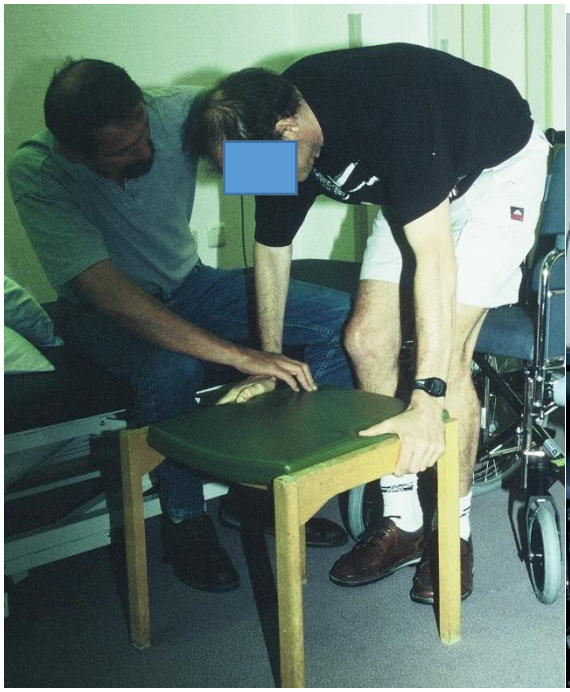


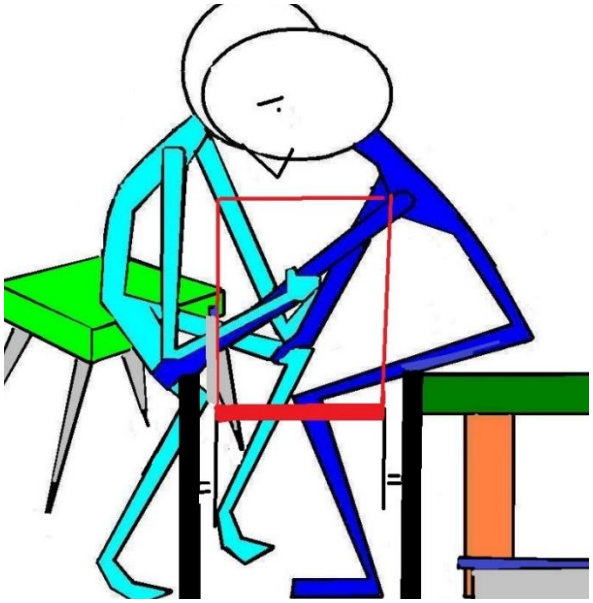
Photo 5

Photo 6

Photo 5 and 6.
Two examples of support exercise one (5) very low with the hand over the edge of the side of the crunch but this was not possible with the knee fully extended. Too much traction on the nerve system. In photo 6 standing position with the trunk more in an erect position and holding and look around but hold the support on the legs and arms. The weight that now stand on the wrist is great. Therefore be careful that the load not hurt.
Photo 5 and 6 published with the responsibility and permission of the author by j.v.d.Rakt.

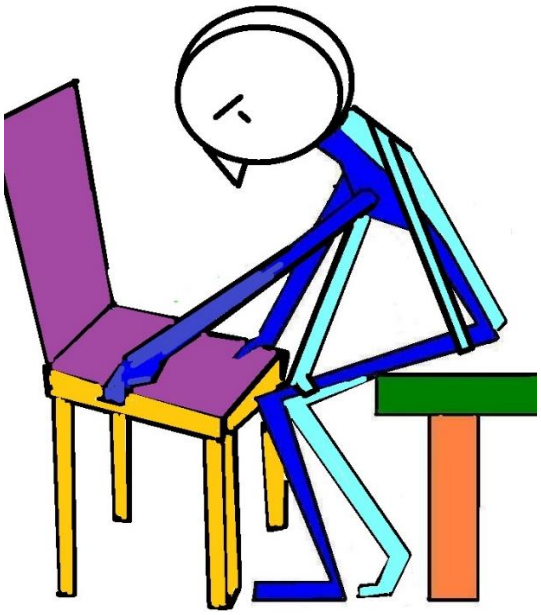
An support on the side rest of an chair is also possible.
Holding support and going to sit isn't easy when the bench or chair is low, also start with an high chair or bench but it is one of the best exercise to learn individuals to sit down slowly and gently.
Standing up from an chair with support in the front is an exercise in which the movement standing up is perform with an upper trunk in flexion[29]. When the chair or bench is of the good height, than there is

no need for an movement in the ankle to correct the amount of weight over the feet and can some also learn to do this movement. That will translated to the ADL with no hand support but when he is capable to hold the affected hand on the chair surface will that mean that he managed the movement without an retraction in the upper trunk on the affected side.



Picture 5

Picture 5.
Using the support technique to the front to get an better movement to stand up.
The hip joint stand higher than the knee , therefore is an good "Vorlage" enough to get an perfect upper trunk forward for an standing up movement with support on the knee of the therapist. And by make 3 small movement to the side this can be an exercise to learn to get in the chair with support in the front. Three small movement sideway is necessary to prevent an injury of the knee of the affected knee.
The amount of support makes the balance problem very small and the fair for the movement to the front isn't often there.
Picture 5 published with the responsibility and permission of the author by j.v.d.Rakt.



Picture 6

Picture 6.
When there is more assistance needed by performing the standing up procedure than can this facilitation be useful.
Of course will the affected hand in supporting function, when there is only little power not really support on the edge of the chair but now it is important that this hand stay on the edge and that the control of the upper trunk stay when he is standing up. The therapist can facilitated the protraction of the scapula through his shoulder against the scapula and hold pressure on the arm. Other hand of the therapist is on the affected knee to facilitated the standing up movement.
Next step is only the affected arm on the chair as an support.
Picture 6 published with the responsibility and permission of the author by j.v.d.Rakt.

When there is an amount of power in the affected arm and when he is supporting on an surface than it is important that he make use of this ability to make extension with elbow with protraction but without an endorotation and an dominant abduction and that he retrain the ability to give an lot of protraction in the scapula or extension in the elbow. Train on selectivity that often start with more and less protraction and extension an later on with protraction and retraction or extension and flexion. He must learn to feel what he is doing and control that. Again in combination with task specific resistance treatment to build up an coordination and muscle power.

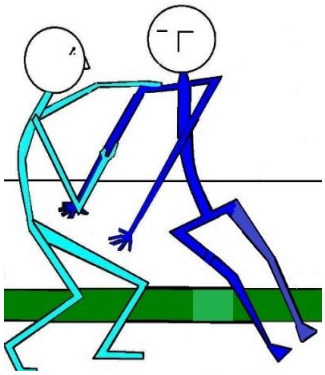
Photo 7

Photo 8

Photo 7 and 8.
They hold the extension and the protraction or make the protraction less and let the chair come to you. That can also done with the extension of the elbow. Important is the hand placing. This an dynamic closed chain on the affected side but all individuals with an stroke makes the other chain also closed.
Photo 7 and 8 published with the responsibility and permission of the author by j.v.d.Rakt.

Working in chains make look that the synergy influence is diminished, but through the closed or dynamic closed chain the distal part of the arm is in an fixed position and that makes it impossible for the arm to go into endorotation and the use of the synergy is lesser through the creation of less freedom possibilities [30,31]. But when this fixed position isn't there, this will happen. To improve the power and the coordination, that is only possible by task specific resistance therapy and using of the possibilities by the individual in their ADL. Because the ADL is using the possibilities by dressing etc. and not specific what can my arm/hand. This resistance isn't so difficult, how easy it is to give resistance and exercise with 75% R.M. and make 3 sessions of 10 rehearsal. With that chair it is also possible to push along the chair on 4 feet and pull him back, this with no load or with an load 75% of 1 R.M. This can be done in an session, that the individual must also do another task to stimulated the brain to separate the attention on two elements. (Double tasking[32]) That we also need when the individual will dress himself, he need than also an part of his attention to the clothing and the position of the arm. Therefore the dissociation is present but the change to an open chain will be impossible. The increase of coordination must be further develop by using half open chain and "open" chain that are not total open. An very important part of good support possibilities is the pressure that people can set on the wrist than the support has an good base and when the individual is capable to place his affected hand proper, he can use the support and create more balance area. Support increase also the power of the diagonals on the front and back and by stimulating the angle of the diagonal the homolateral structure will become an part of the whole system again. Photo 8 gives an photo of an resistance against the extension of the affected arm but it ask also an protraction and therefore an increase on contraction / recruitment of motor units[33] and tone in the front diagonal to the not affected leg . She create an closed chain on her not-affected side by support with her not-affected arm on her not affected leg but that increase also the power in the front diagonal to her affected leg. When the resistance is very high , almost 100% R.M. than we see that the affected leg goes in flexion (hip) because the front diagonal to the affected leg is now complete and the flexion in the hip gives an lift in the affected leg. But look to the photo she move to her not-affected side and the weight on the affected leg is lower and therefore the chain is less closed and the angle of diagonal in the affected hip is changed[7,8]. To increase the contribution of the

homolateral structures it is important that the support exercises are further increase to that side and also to an support training with two arms to the back (back support on the cough).
What first?
Isn't so important, but realize that support training is heavy for the hand and especially for the wrist. Therefore you can decided to start with support exercises on the not – affected side because the not-affected side can bear the weight. Otherwise can it be an problem to get so much rotation and protraction in the affected side and shoulder that this is very difficult .



Picture 7

Picture 7.
Start with placing the not-affected hand on the bench. That is not easy, but necessary to prevent too much weight is coming on the affected side. The arm/hand of the therapist are important to hold the shoulder in an good position with protraction and this is good to handle by placing your elbow between the thumb and first finger and hold the arm just above the elbow. Be sure that the arm is so well positioned that there must be an support action. This give an action in the gleno-humeral joint and then is it important that the alignment of the joint is good because otherwise it can be traumatized.
Picture 7 published with the responsibility and permission of the author by j.v.d.Rakt.

The trunk must have not too much flexion because than is rotation of the spine difficult but also not too much extension and especially active extension. That can give an retraction in the scapula and that can give an flexion movement synergy. But as in picture 7 is showed there must be an weight transfer to the affected side to create an reason for this support.
The not-affected hand is placed first but that is difficult because placing of the hand over the affected leg is an movement of the lower trunk thus there must be an transfer of weight and that must the not-affected hand controlled and that with the base of the front and back diagonal in the affected side. This base is the most important one, to control the support action on the affected side. Individuals with an stroke find this very difficult therefore start with placing of two arm to the side without transfer of weight of the lower trunk and therefore give always assistance. No shift of the lower trunk makes this support action, an action without an goal.

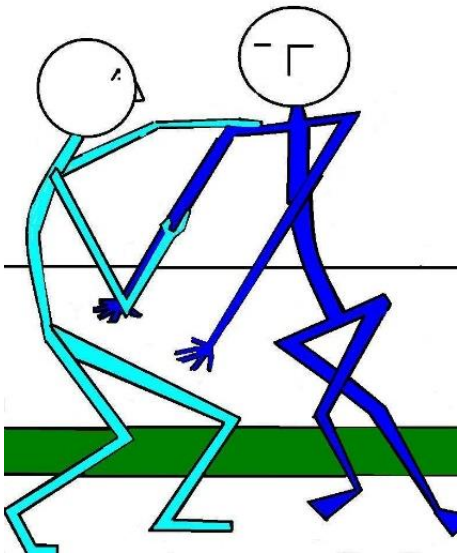
Photo 9

Photo 9.
Starting with support exercise on the not-affected side. To get the possibility to transfer the weight in the lower trunk, here is choose for first placed the not-affected hand so far as possible placing on the bed on his not-affected side with the upper trunk in flexion. Than placing the affected hand with assistance and build the support further on both arm by moving more the weight on the arms by making more extension in the upper trunk and more sideways movement with rotation in the lower trunk and the not-affected hip. At the end an support with the affected side and an reaching through the not-affected hand (ADL)
Photo 9 published with the responsibility and permission of the author by j.v.d.Rakt.

When the placing is succeed, than is an further increase of weight very important and this can also be changed in an task specific treatment with the load that the affected arm must bear. To protect the affected hand, the therapist can placed his fingers in the hand inside and feel how much the support is and support the alignment of the wrist and hand inside.

Photo 10

Photo 10.
An support control of the affected hand, here the fingers of therapist may go further to support the whole inside and feel the pressure. Even one fingers can go to the mid of the wrist.
Photo 10 published with the responsibility and permission of the author by j.v.d.Rakt.



Picture 8

Picture 8.
In this example we asked the individual to lift his not-affected leg and place it over the affected leg. To do this, he must sit on his affected hip and in that affected hip there must be some active exorotation present. Without this exorotation it is impossible to get the not-affected leg over the other leg. The support with both arms makes the transfer over the affected easy because there is no balance problem through the support of both arms. But without an active exorotation in the affected hip is placing of the not-affected hand very heavy. Good placement of the hand is necessary to get an possibility to exercise the lower trunk. To close makes the movement in the leg impossible. Still this support action can also use as training of the exorotation of the affected hip, even with load.
Picture 8 published with the responsibility and permission of the author by j.v.d.Rakt.

This movement – crossing of the legs is very important because this can be an possibility to get in the trousers. This exercise is the learning route before this. We can use this exercise to get more support on the affected side to get more exorotation in the lower trunk but also to get an support on the affected arm/hand in which this arm/hand stand more lateral and backward as in all other support exercises. And we can create that this support can be used to free the not-affected arm to do other things. And we can in this create stimulation by:

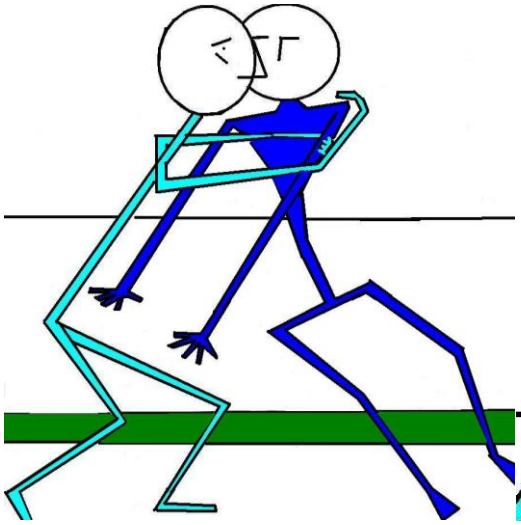
More load ;

Sitting on the affected side will lifting the affected arm be an very heavy exercise for the affected hip and lower trunk with crossing legs. Be careful and try to build the load gently up but there will be an moment that only the diagonals from the affected hip to the not-affected side must do the job and then be prepared to give assistance and control the flexion movement synergy on the affected side with an little pressure to hold the extension in the elbow. Lifting the not-affected arm will ask for an strong action of the affected arm in extension in the elbow and holding the good protraction because the affected arm stand now further lateral and backward and this diagonal will go from the affected arm/hand to the not-affected leg and you will observe that the not-affected leg will “squeeze” the affected leg to create an fixed closed chain. More load is for everyone different. Therefore it is wise to do the exercise self, to feel how heavy this exercise is and also where the possibilities lie to increase the amount of load and make it an Task specific resistance therapy. Crossing the leg and support on the arms is heavy but try this :

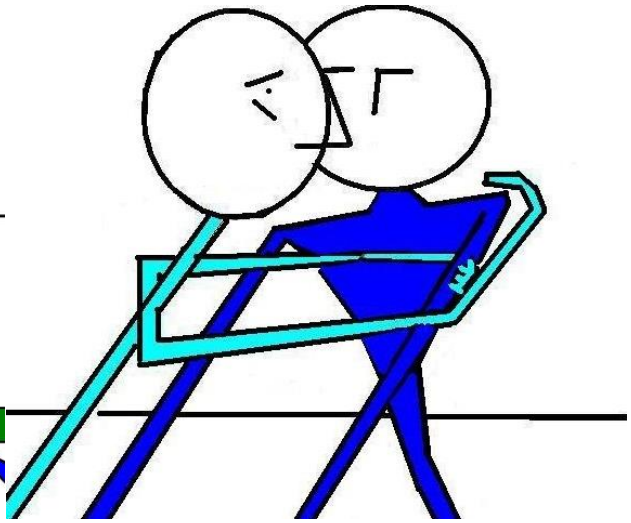
Do it self **:** Placed your both arm/hands so far as possible to one side and cross your legs. Be sure that you are out of balance to that side were the arms/hand stand and lift now the arm that stand most far to the back and keep this sitting position !! Be careful and good luck.

Selectivity increase;

When the support on both arm is possible and the crossing of the legs also, you can try or the individual is capable to make more protraction and less. Thus less means no active retraction but less concentric more eccentric protraction. That can he do with making more flexion in the upper trunk and then more extension, with more load this can also be done with more or less exorotation in the lower trunk and holding the upper trunk in an stabile extension and react with an movement of the scapula.



Picture 9



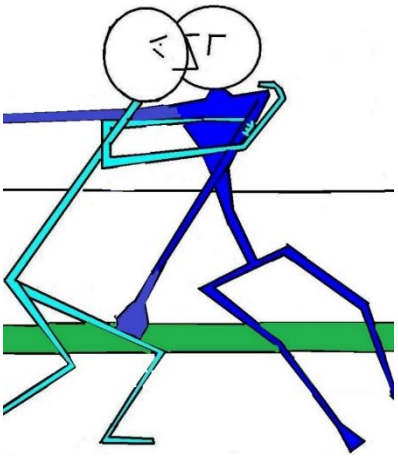
Picture 10

Picture 9 and 10 .

Sideways support but now to the not-affected side.

This is for the affected arm/hand very heavy especially when the not-affected arm is lifting than must the diagonal from the affected upper trunk together with the hip and spine of the not-affected side do the job [7,8,9]. Of course there is more stability in the lower trunk but the load on the affected arm hand is very great and especially when the affected leg is cross over the not-affected leg. The facilitation technique is also important one arm placed the underarm against the sternum and the hand grasp the upper arm but go far with hand under the upper arm and grasp than and rotated back. That gives more exorotation in the shoulder and will help to place the affected arm optimal. The other hand is on the shoulder on the backside to prevent retraction. Together they can also help to get load on the affected arm. Lifting the other arm (not-affected) and reach as far as possible to grasp something will give this exercise an purpose and that is important[34].

When this position is stable the crossing can occur or lifting of the not-affected arm. The load is than increasing with an lot of possibilities to variated [17] and start with an transfer to the ADL. Leg crossing can be difficult by the affected leg. It ask for an stabile tone in the stomach[8], even an short concentric contraction and the flexor of the hip must be capable to be active in an very short muscle length position. Therefore it is sometimes better to assist with the hand that is behind the shoulder.



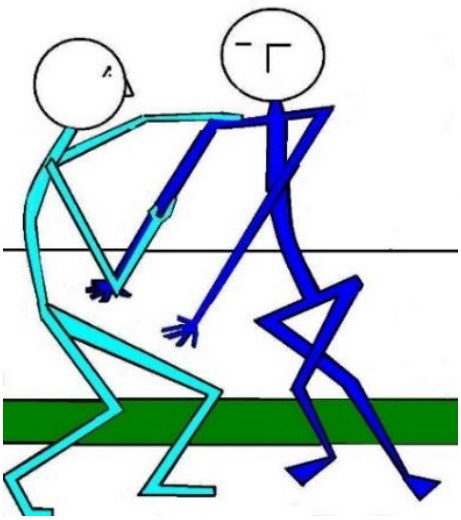
Picture 11

Picture 11.
The weight is good on the affected arm/hand and the individual has try to move his not-affected hand an little bit to the rear of the bench and the affected arm has hold this increase of weight. The hand is placed with the finger over the edge to prevent too much pressure on the metatarsalia. Sometimes is an little towel under the hand good to prevent too much pressure on the wrist joint structures. Now it is possible to increase the load and make it an task specific exercise. In this case without crossing the leg but that increase of load is also possible and that will give an positive effect on the muscle strength but also on the coordination of the affected arm.
Picture 11 published with the responsibility and permission of the author by j.v.d.Rakt.

Picture 9 let us see an good support with an closed chain between both arms. What shall be the activity be of the extensor of the elbow , the muscle triceps? In German literature this is called : “Außer Gelenk Function “[4,35] and that means that the muscle that should be active isn’t active because it isn’t necessary. In this case the extension of the arm is hold by the great breast muscle – the muscle pectoralis major – his adduction gives an extension in the elbow without activity of the triceps is necessary. The first step, is to achieve there is an possibility to support on two arms, before one arm is free from the bench. The second step, when we want to know or there is enough extension power in the triceps and that can be achieve by asking to bend the elbow –outside- and hold and extend back till the elbow is almost in full extension.

Back support.

When the support sideways is going well, we go further to create an support behind the body. One of the attitudes that we use when sit on an bench and lean back. This back support ask for an retroflexion, exorotation in the gleno humeral joint. Extension in the elbow with supination and the right wrist position with extension in all fingers (we can use the edge of the bench when the full extension isn’t there.) The scapula make an active retraction. Start in the side position and again you can start with the not-affected arm as the first support but then must the affected arm over the leg to the other side and that means that the mobility in joint and muscle[27,28] must be perfect. And often the back support isn’t possible because the mobility of joint, muscle and especially nerves isn’t intact. Bringing the affected arm to the rear will then be an great problem and then the only solution is to start on the affected side with support and give the not-affected arm the possibility to go on the other side to an back support position. Be careful!



Picture 12

Picture 12. Go to the back support situation.
Start with this position with the crossing legs because now the tone in the lower trunk as in the upper trunk and arm is optimal. Than un-cross the legs, hold the affected arm and change the position not aside the individual, but more behind him. Now you can placed your upper leg against the back of the individual (photo 13) and has an greater influence on the trunk and exercise there also selectivity.
Keep sitting on the side is also possible and especially when the mobility is poor and that is the treatment to increase that. The not -affected arm hand is placed to the other side and we have an back support.[27,28]
Picture 12 published with the responsibility and permission of the author by j.v.d.Rakt.

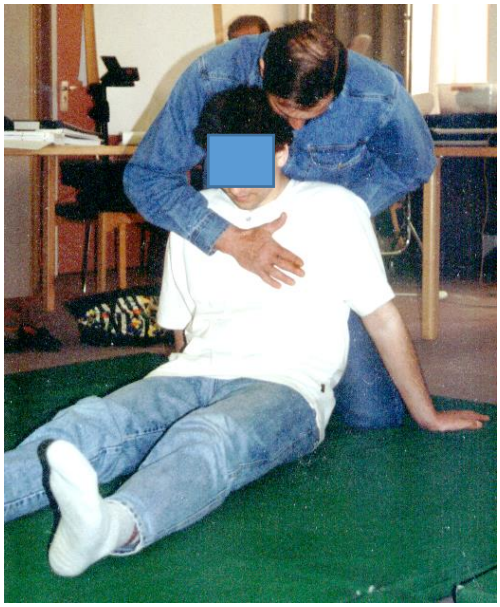


Photo 11

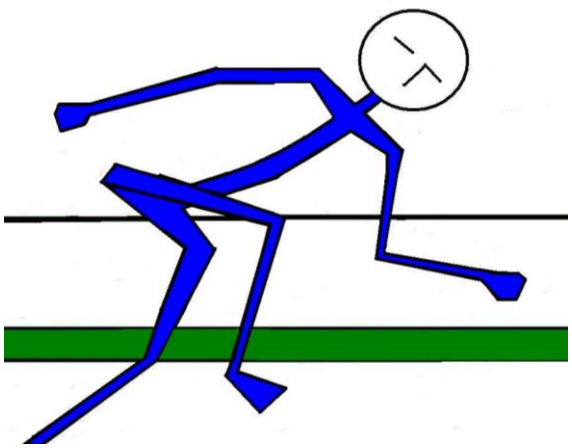
Photo 11.
Sitting on an mat after experience going to the ground and back, exercise on the mat in an back support position. In this case this is an treatment to move with the upper trunk in flexion (more protraction) to upper trunk extension (more active retraction) and hold an stable support on the affected arm. Exercise to give more selectivity and by lifting the not-affected arm this will be increase the load and it is an task specific resistance treatment. The lifting not-affected arm there can also hold an weight and that weight can go to the front , to the affected side or the opposite and again increasing load!!We can also increase the load by crossing the not-affected leg over the affected leg and this can be further combined with an movement of not-affected arm to the affected side.
Photo 11 published with the responsibility and permission of the author by j.v.d.Rakt.

In this back support position we asked an lot of the mobility. And seek were there are difficulties. Look to the position of the head and asked if he can turn to affected side. Feel of the joints and the scapula stand in the correct position, when you not sure let the individual make some flexion and extension movements in the upper trunk. And see or the movement of the not-affected arm goes further because that means that there is more relaxation now the spine has move and that is combination of muscle tone / synergy influence and joint position. Now ask to move - gently- the head to the other side and observe or the individual still is capable to hold the extension in his elbow or that there is every time an flexion of the elbow. To get an differential diagnosis we can set more stretch on the nerve system by extend one of the legs, when this reaction than occur faster it is likely an nerve problem. Has this no influence and the extension in the elbow cannot hold than it could be an static reaction[6]. An Asymmetric Tonic Neck Reaction, when the head is turn to the affected side than is extension in elbow easy but when the head is turn to the other side than there is an flexion in the elbow that cannot

different. When this is the case (A.T.N.R.) than be aware that you are on the border what is possible and is this exercise not the right one.
When the nerve structure is the reason, than must first this be improve by “slide “techniques[27].
Task specific resistance treatment, give an pull, push on the affected arm so that it is difficult to hold this standing position . That is an R.M . close to the 100% rehearsal 6-8 times and that 3 times . 3 times an week. Variation in all direction and with or without crossing legs. Learning how to get the best support on the affected arm by do something with the not-affected arm . Touch an ball or balloon or with an stick to sealing ect. Still it is an support system with closed or dynamic closed chains. That means that the contribution of the keypoint muscle isn’t great. Now the accent is lying on the dissociation.
Still there must also an transfer to the ADL. This ability to support to front, sideway and back must be use in the ADL and that is very important because it will then faster automatically. But often must the individual well be capable to place his affected hand on his own or through an skilled nurse, in the right position to get an good support moment.

A.D.L.

We say the reason why support sideways is so important. Because now there is movement on one hip and is there an possibility to cross the legs. When there is no weight transfer, than there is also no crossing of the legs. This crossing will be further develop without support or with support of one hand, till the position is reach and then there are two arms free to get the trousers on or with one hand.
Sitting on the edge of the bed and reaching to the clothes that lying on the bed, we all take support with one hand and for the individual with an stroke who can place this, will be very helpful. Or when there is some that lying on an chair and this is too far away than can support on that chair give an greater reach.
We use than standing up with support and reach with support. An important moment is, when an individual with stroke is in an standing position and the balance is weak and he must reach or bend to take something.
Than can the capacity to get an extra support, be very
important to get an greater independently .



Picture 13.
Examples of the use of the support training.
To be able and cross the not-affected leg over the affected leg it is important that the weight transfer is possible. Here the support on the elbow is possible and this weight shift is enough to cross the legs.But this was also use to get on the edge of the bed out of side lying position and also back in that position.
Start with elbow support and increasing the amount of extension in the elbow.
Picture 13 published with the responsibility and permission of the author by j.v.d.Rakt.

Picture 13

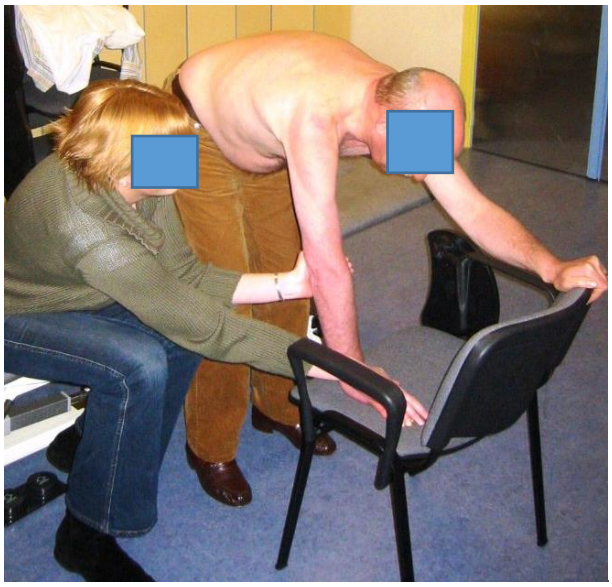
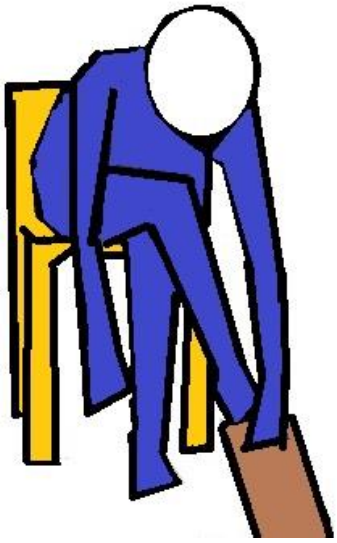


Photo 12

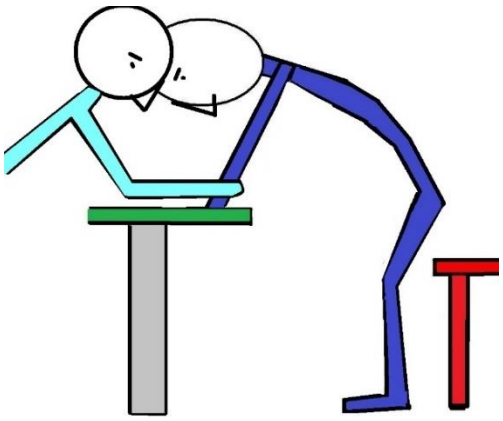


Picture 14

Photo 15 and Picture 16. Photo 15 closed chain but the other arm is on the top of the chair and will be free to reach and grasp. But also is capable to grasp the trouser and lift them.
Picture 16. Sitting on chair perfect crossing the legs and with the not-affected leg in the middle, other leg is good cross, good control from the lower trunk and the affected arm isn't be capable to help thus this lady do it with one hand.
Photo 12 and Picture 14 published with the responsibility and permission of the author by j.v.d.Rakt.

Support training in standing position.

When the trouser is on to legs and the socks and shoes are also, now must there be an activity in standing position to get the trouser always over the hip and closing. That means that the individual after an stroke must capable to bend in an standing position to pick up and stay stable. Bending movements is for an individual with often little perception very difficult. Often he will control his balance with his not-affected leg, but when he is capable to use the diagonal from the not-affected leg to the affected arm, than the stability is firmly increased and he had one not-affected hand free to do the job. This must be trained and learned and executed on ADL level so soon as possible. Bending is so very important because it will contributed an lot in his independency, but also lessen his fear for falling. Therefore are activities on the mat as on photo 13 important, here as an training backward-support, but to get on the mat is very important part of the training for losing the fear of falling and also an training to get up. Bending and support seeking give the individual the opportunity to go close to the floor or go on the floor and back, this will often give so much more confidence that the fear of falling is decreased.



Picture 15

Picture 15.
We start with an support attitude after an transfer from sit to stand with an upper trunk in flexion.
We know that this is the most easy way to get to an standing position [37,38] and pulling with the not-affected side with the elbow in flexion on the bed or bench /table gives an increase of the movement of the upper trunk to the front and enough "vorlage". But we know also that the extension of the leg in the last part is difficult and the support on the affected arm is difficult[29]. Start with task-specific resistance treatment.
Picture 15 published with the responsibility and permission of the author by j.v.d.Rakt.

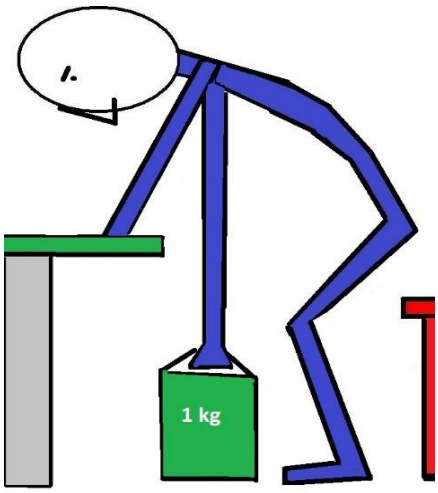
Task-specific resistance treatment:

First: for the extension of the knee and we search for the right R.M. and can make an exercises program that will increase the power of the extension of the affected leg. But there is enough evidence that also the not-affected leg (or arm) is affected and that should be through the crossing of the brain pathways[38]. This coordination increase is often visible by an better standing up procedure and more weight distribution. Think on the learning aspect[17,18], rehearsal with variation and the individual will be capable to stand up for great number from sitting position and able to stand with the knee in good extension.

Second; the standing attitude together with the support on the affected side must be trained. We start in support on the elbow now the front diagonal must be active to hold and press the elbow in the surface (and start with an bed, that gives the feeling from sinking in the bed and that is an positive sign of the pressure the individual give). To increase the power and the coordination we can give task-specific resistance therapy not alone stimulating the pressure on the surface but also increasing the stability of this attitude . The resistance that the therapist can give, is with much variation.

Third: is to learn how he get his affected arm by himself on the surface. This must be done in an standing position and then must an moment the standing position be done without an the support. Especially when there is still no keypoint muscles active, he cannot lift his arm on the surface, he must than lift him with his not-affected hand and place him on the surface.

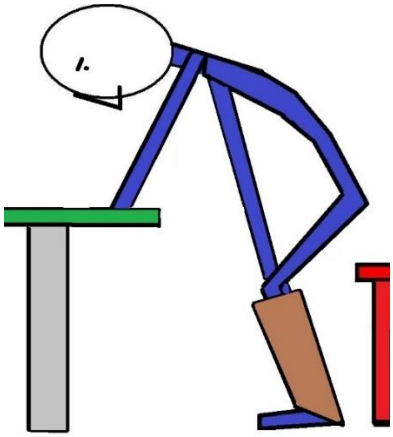
Fourth: he must give weight on that elbow and feel that the support is good. Therefore this exercise is very important and must be done especially in the ADL when this possible. Thus when the physical therapist is training the standing up and stand on the bed, there must be also an introduction for an elbow or when possible an whole a support .



Picture 16.

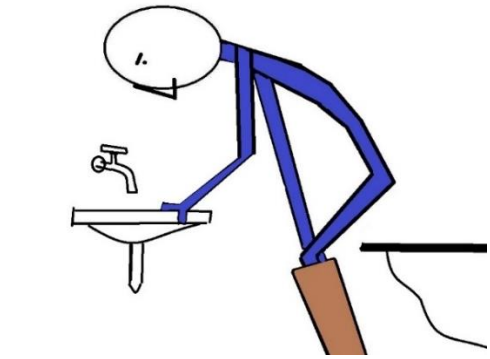
Picture 16.
An example how to increase the load in this standing position but also the great amount on variation that is possible. The load can be increase in the not-affected hand with the affected arm support on the elbow or even on the hand and make extension in the knee and flex again and that can also switch from one leg in extension and the other in flexion. But also can we transfer the weight easy by swinging the load with the not-affected arm. When this the individual has managed than it is very important that it is introduced in the ADL because this will increase his independency and focus him on the ADL and less on the support. He is able to hold an support an doing double tasking[39] !
Picture 16 published with the responsibility and permission of the author by j.v.d.Rakt.

Swing with this weight will also give an transfer of the weight through the whole body therefore he will experience that the load on the feet changes. This is also an method to increase the somatosensory of the affected leg together with the muscle force /coordination will that stimulated the damage brain. Caring an weight in one arm and swing with it will increase the pressure on the feet and this difference is often felt under the feet especially under the affected foot and can contribute to an better weight shift. One of the most difficult thinks for al stroke patients [40]. The control of the flexion in the knee is important because when the individual is only capable to stand with support with the knee in extension, he will never come with his other hand to his shoes or the floor. Now to the practice of every day and be sure that there is also an exercise moment on other locations and also at home make it an part of the daily activities.



Picture 17

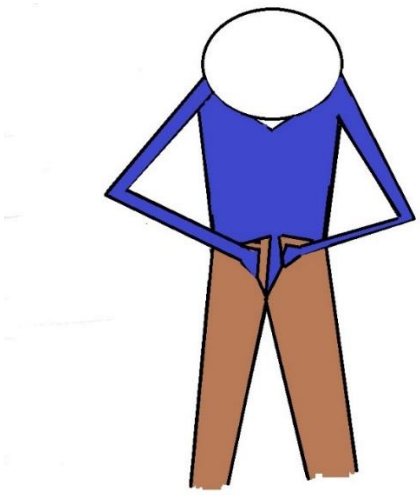
Picture 17.
The practice with the trouser and know that individuals with an stroke have difficulty to “generalization”. That means that on the bed it will succeed but when they are some were else this isn’t so easy anymore. Therefore search for the different moments that this skill is necessary and exercise on it. Here still and elbow support but placing the hand proper maybe this is also possible. Variation is important; Making the movement in stand with an towel along the leg to the foot or pick up an towel that lies on the ground for the feet. This part of the ADL is for all members of the multidiciplinair team.
Picture 17 published with the responsibility and permission of the author by j.v.d.Rakt.



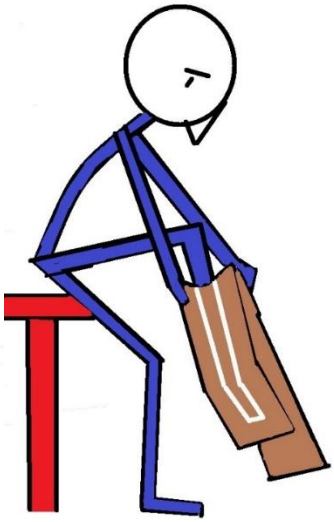
Picture 18

Picture 18.
At home in their own toilet and what we see that the washbasin is on the right place to get the best support with an upper trunk in flexion and the best support to bend and grasp the trouser from the floor. Support is also possible in the washbasin even on the elbow and provide an good support. Still search and train also there because every situation is different and asked for training to get some generalization.
Picture 18, 19 and 20 published with the responsibility and permission of the author by j.v.d.Rakt.

Look were the brackets often are on the toilet and shower. On a place that isn’t right, that makes the independency not bigger and the individual will need the support on that place because his must hold his upper trunk in flexion to bend to the floor and stabilized his balance by making an closed chain of the diagonal from the not-affected leg to the affected arm . Otherwise this whole achievement isn’t possible. This an strange phenomena that often the brackets were placed where the professionals think the must stand but not where the patient they need. This count also for an wall on the not-affected side that makes it possible to lean against it ! When this independency is reach, be sure that it is total and everywhere. The closing of the trouser is the last piece that must be master because otherwise the individual must go to another person for help. And when this is possible than there also other ways to managed the problem of bending and picking the trouser. And be aware that stroke patient will need for solving from problems , the damaged brain must be challenges. So it is common that individual stand on the trouser with the affected leg and pull so hard the can but no movement and not always feel they what the reason is from this obstruction .



Picture 19



Picture 20

Picture 19 and 20 gives examples what is mean by total independency. This can be learn by using par example the tactile kinetic guiding method [42]. To get one part of the trouser stable, push firm against the stomach and make with the not-affected hand the trouser closed. Or sitting against an bench and use the two hand to get in the trousers without an support in the front because the possibility of hand/arm are increased. Here is keypoint activity in the shoulder necessary. Dissociation will ask management of the closed chain with one or two arms. From elbow support till the whole arm support, but the activity of the shoulder is minimal and that is the difficult part, because here is an important keypoint with an lot of small muscles that can make all kinds of movement and that is "cortical" work. Not equal with the selectivity of the hand and the fingers but there is more selectivity necessary in the shoulder than in the elbow. To reach that level the closed chain must open. Picture 20 gives an example but there is still an "chain", but the trouser has no stability therefore this is almost an open chain. To get an result in the keypoint there must be an treatment with task specific resistance to get an possibility to increase of the coordination[42,43] and that ask for half open chain with or without dynamic and this is an treatment that will can asked for an lot of time.

Further restoration of keypoint muscles. (Part of the dissociation exercises)
Dissociation from the movement synergy's is possible through the creation of an closed chain. That can be reinforced by an support point on the floor, moving over the floor or only as an support point. The closed chain with 6 muscle pattern or the dynamic closed chain with also 6 muscle pattern but with more movement , therefore will the inhibition lesser but the facilitation of the muscle pattern greater..
Dissociation will exercise only an part of the muscle chain between both arms and that makes it easy for the muscle of shoulder, because not all muscle in the shoulder must do their jobs. There is an dissociation between the elements of the both movement synergy but without the selectivity of the shoulder. This is important to realized that especially the smaller muscles with their specific function will have an minor impact. The larger muscle will do the job especially when an great amount of force is used. **Therefore how subtle the movements are there greater the change that also the minor muscles collaborated.**
Another reason that this –support- dissociation will succeed by many individuals is that the hand has not an very important role. The support must be possible and even in situation that only one hand must be the base of the support almost never is there an need for strength in the hand. Strength in the hand is an kind of selectivity and perception in the hand[42]. Because when hold something that is heavy or get heavier than there must be an possibility to feel that and an possibility to react. Still this is possible by individuals after an stroke despite the cortical pathway is damaged but very often will there an border and will the hand not cooperated and par example holding something in the hand and suddenly the hand open and the piece will fall out. The system isn't capable to control the grasp because that is an high cortical function. When we therefore start with the keypoint exercises that focus the treatment on

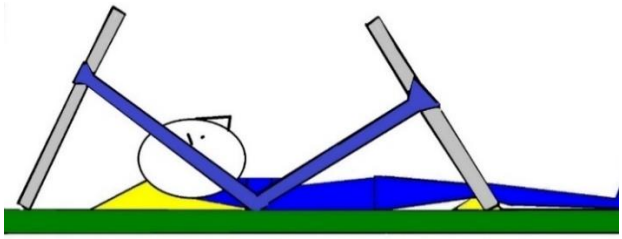
the shoulder but will have the greatest advantage when it is able to place the hand in an proper situation that is very useful for the individual. But the hand will therefore also the limit of what is possible and what not especially when there is an bilateral action possible that ask for equal power in both hands.

Photo 13

Photo 13.
Holding an case asked for an power in the fingers on both side . With this amount of weight and treasure, it is an very great pity when the affected hand suddenly open and the case falls to one side. Therefore is this box so manufactured that an amount of force can be created through the adduction of both muscle that through the "Ramiste"- reaction can be increased and asked not so much power of the fingers. But adduction is still an major part of the extension synergy and let it not dominated.
Picture 13 published with the responsibility and permission of the author by j.v.d.Rakt.

Carry an case on this way is an half closed chain but there is an part that is closed and that is the part against the knee and later on against stomach. But the hand left and right must hold the weight and the arms must active in elbow , shoulder and scapula thus both front and back diagonal. But there is more because when we reach the point where the case must be, we must be able to maneuver on the right placed with two arm with the hand holding the case. Be aware that task –specific resistance treatment is always possible but with the keypoint exercise there is one obstacle: "What can the hand and when that is the greatest problem, search for another exercise, because it benefit not the keypoint the shoulder and therefore also not the hand." To increase the power and the coordination the task specific resistance therapy is very important together with the learning process of rehearsal with variation and the translation to an daily use of it. That will be always the challenges that makes therapy - real therapy.
In which situation we can exercises? In all situations because we need our shoulder movement every were. In the part over the transfers in bed there are enough examples were an support possibility will help but when that support has also an movement in the keypoint is this movement easier to do. Therefore when you looking for ADL make it not so difficult but search also in all the movements that individuals make to move in bed, out of the bed , standing up etc.

Training control over the shoulder- Keypoint control!
Therefore the control of the shoulder in the direction anteflexion / abduction, adduction and retroflexion must be able and after that, the rotation and the combinations. To get this selectivity we must often start in an position that isn't too difficult or too heavy. Still often this is consider as exercise without meaning for the ADL , but that don't have to be true, because exercise can be created an climate that there is an very good pointing on the pattern of muscle reactions that therapist want. But make not the mistake to create an exercise that has his importance on the performance for the individual. That performance is important but that is the therapist part, the creation must be so that the result is important for the individual that he feels that he has achieve something and can do some else better. That he/she can use to make the ADL lighter.
We can divided the exercises into two parts;
1. The position in which the exercise will be performed.
2. Which chain we use. To stimulated the keypoint it is often an half closed (dynamic) chain all away to an open chain, when possible. The first position is lying on the back on an bench. That position will stabilized the upper trunk with the scapula and the gravity is different and through that it is often possible to move the arm on shoulder level.



Picture 21

Picture 21.
Lying on the back hold the stich on the position. Thus inhibited the abduction /adduction component with some rotation. This stich can be filled with sand and give therefore more stability but also load.
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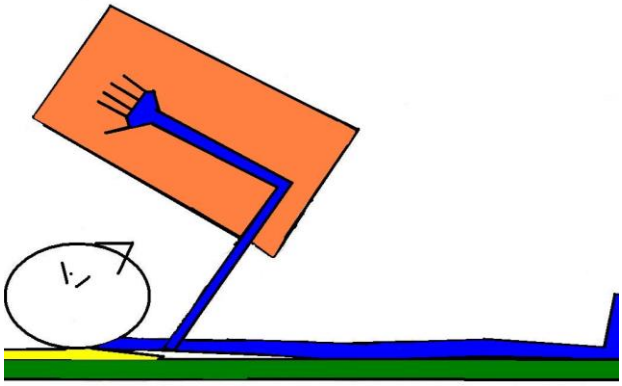
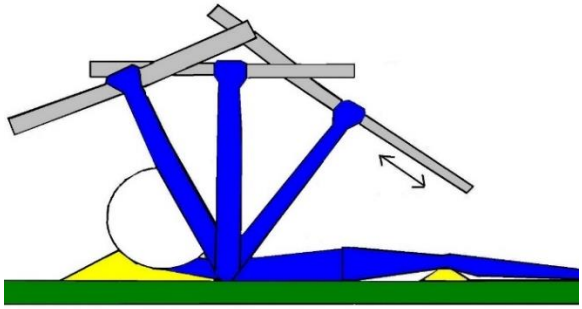


Picture 22

Picture 22.
Often is an extension and moving up and down still very difficult. To hold this box between the hand and elbow ask for an exorotation with adduction and still an anteflexion. Example is which subtle is essential, instead of force!! And here is anteflexion in shoulder possible with control on the adduction/rotation.
Picture 22 published with the responsibility and permission of the author by j.v.d.Rakt.

Lying on your back the gravity has another “angle”. From 90° anteflexion the movement over the head to the bench is an eccentric anteflexion and from 90 ° back beside the body is an eccentric retroflexion activity. Eccentric is “easier” than concentric and therefore start with the eccentric part and make that an exercise with load that will increase the power and the coordination of the muscles that take part on the retroflexion and anteflexion movement. “Easier” because the movement is there but there is an great discussion about the cortical control and the effects on the muscle itself [45,46,47]. But there is an movement that can be control thought the patient and that is very important ! Than try to make it an isometric contraction before we go to exercise concentric activity and the activity back over the head is often the easy one, because the muscle is on stretch. How must load can be given ? Picture 22 shows open fingers but when there is load this will changes in more flexion. That is sign that the intensity is growing but still no reason to stop this exercise. When the synergy go to play an obvious role, when we see loss of exorotation/ adduction than the movement over the head isn’t possible, than the load is too high. Picture 21 has often need for an heavy stick because than the movement away is better felt and there is an reaction possible. When there is maybe an *lift* moment possible than start with the stick over the head and ask to hold this stick an moment from the bench and then back again and stabilize. Both exercise can be very heavy and stay focus on the mobility of the scapula and gleno humeral joint. Also look with holding of the objects, that the head isn’t pushing too hard in the pillow. That will increase the back diagonal on both side and fixated the scapula and that will go in retraction and make an good movement in the glenohumeral joint impossible.



Picture 23

Picture 23.
Start with holding behind the head or eccentric slowing down of the movement with the performance to hold the stich so that he landed beside the body or head. Anteflexion shoulder with extension elbow and exorotation.
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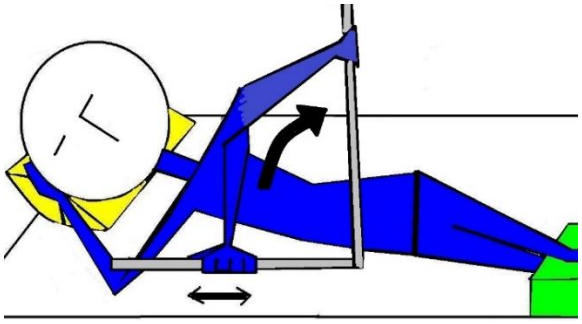
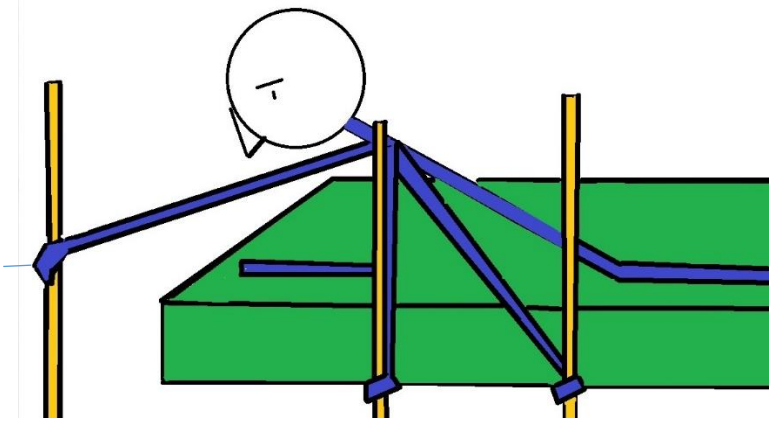


Picture 24.

Picture 24.
In side lying position on the not-affected side. The stick is placed on the bench and go down and stand right. This must be give an activity in the muscle of the gleno-humeral joint but the gravity isn't now no problem. Another exercise is place the stick straight, abduction with extension elbow and controlled retraction. Often the other hand under the head gives an closed chain and better diagonal fixation.
Picture 24 published with the responsibility and permission of the author by j.v.d.Rakt.

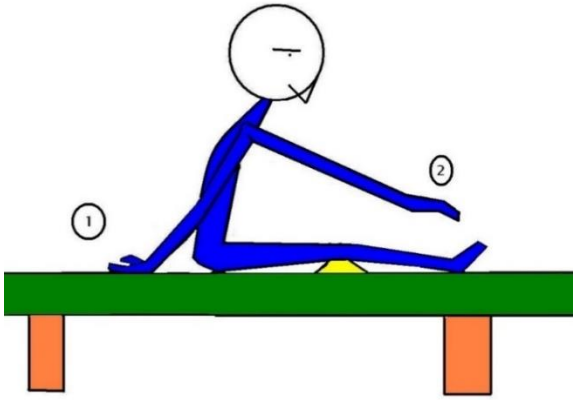
Always an difficult part the retraction of the scapula, but this is still an part of our movement and here we must hold the extension and with little movement in the upper trunk and set the stick straight . That ask for control that the stick stand on one place and that ask for rotation control in the gleno – humeral with an elbow extension and an push in the bench.



Picture 25

Picture 25.
Lying on the stomach and support with the not-affected arm on the elbow, first try to hold an stick on one place straight that ask for activity, lift or shove the stick. Resistance can always and in the beginning is that easier to hold and controlled.
Picture 25 published with the responsibility and permission of the author by j.v.d.Rakt.

The high of the bench will differentiated the difficulty and here is an exercise where some possibilities of the hand are important, because when there is well the possibility to lift, we have now an gravity that is similar with sitting/ standing position. There is now an possibility to use the floor and make that an closed chain and an dynamic closed chain and then return to the closed chain and set the stick in the upright position and hold.
When this is possible than there is also the possibility that moving with an *swing* can start.
Swing exercises are often the first open chain that are possible and often the swing will start in the trunk and therefore it is important to look or the activity also occur in the keypoint.

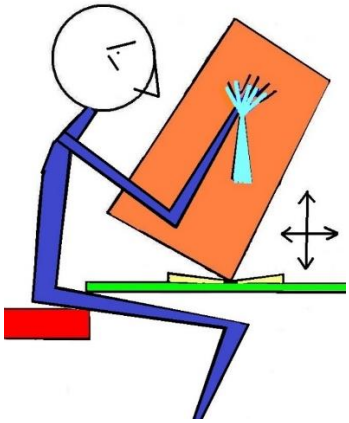


Picture 26.
Strange but in this position bring the arm behind the back isn't often for individual in this stage not so difficult. Be sure that the upper trunk isn't stretching but that he hold an upper trunk flexion and placed the affected arm beside his leg and ask to bring him behind. An retroflexion with retraction and full endorotation.
Picture 26 published with the responsibility and permission of the author by j.v.d.Rakt.

Picture 26

Hand training start in position 1 to position 2.(Picture 26). The hand lies on the back of the hand and this will give an stimulus to the stretch muscle of the fingers. The tendon are through the wrist position elongated and that will stretch also the fingers more. With the weight of the arm /hand asked or he can move his fingers and thumb. We see than an movement without eye control and when we give him something what is hard and eventually cold, he can work on his perception of the hand/fingers.(Ice –water immersion[4]

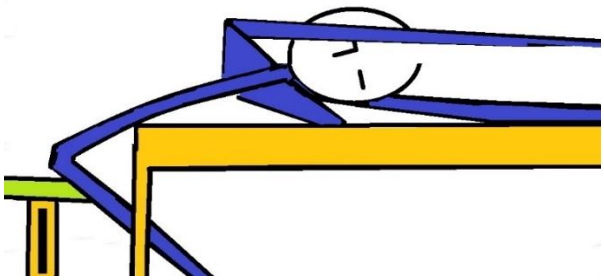
From this position the anteflexion muscle are elongated and the scapula stand in retraction, still the assignment is to swing the affected arm to the front and in the beginning also across the legs to the other side. This is easier and gives more swing power to do it. Activation of the front diagonals [29] Furthermore you see often that the hand will be placed proper and an support action is possible after crossing the legs on the bench and that gives an stabilization reaction in the affected shoulder because the weight goes to the not-affected side. Of course is the placing along the affected side more difficult and that is the next goal, but when it is possibility, make use of the phenomena to swing place and support with an dorsal flexion of the wrist. Also can this movement be done with an load in the hand or on the wrist when the hand is not capable to hold something. Be aware that this position has great resemblance with the slump attitude.(nerve's [27,28]) Especially when the swing goes to the front and the head goes into an flexion this could set an lot of stress on the nerve system. Sometimes it wise to place the feet over the edge of the bench. But not too far because this attitude makes movement elsewhere difficult and give an great focus on the swing movement in the upper trunk and the gleno-humeral joint. This exercises must lead to muscle-fatigue, because we know that is the stimulus we need to increase power and coordination.[22,23,24,25] See the pictures and there were is working with an box , you can also place an stick. That stick or box can have load and that create 50-75% R.M. and we know what to do to create that stimulus to improve the coordination. Variation is the power to come to rehearsal, with motivation and fun and variation give the brain an task to search to the best solution[17,18].



Picture 26

Picture 26.
An dynamic half closed chain eventually with facilitation of the hand (in light blue). Holding the box between the hands and the elbow and the box is support on the table on an towel that makes the moving of the box possible. Holding the trunk in upper trunk flexion is important than first moving over the table the purpose with elbow and hand under control. And when the moving is going well, try to lift and hold or assistance with the lift and hold and low let go (eccentric). Look and feel of the muscles in the gleno-humeral joint are working and observe how the elements of the synergy are under control.
Picture 26 published with the responsibility and permission of the author by j.v.d.Rakt.

This movement with an upper trunk in flexion makes it easier to control the front diagonal and will help to stabilized the scapula. To lift the box many individual will start with an extension of the upper trunk and that will give an retraction and makes an movement in the gleno-humeral joint very difficult. Therefore hold the upper trunk flexion and the table can be of assistance by pushing the stomach against the edge of the table. Now the arms move to far as possible that means that the front diagonal are active and try now to lift without losing contact with the table. This movement can going up but also to the left or right, ask for more trunk rotation therefore more variation in the front diagonals. This is an heavy exercises and often will the hand on the affected site give more tone and it is important that the individual has an way to handle that tone increase. There are so many ways as stretching the arms with the hands in each other on the table far to the front with the stomach against the edge. Now make an upper trunk sideways from the affected side and placed the head on the affected shoulder and push the shoulder on the table. That will reduce the tone especially when he stretch the arms and rotated the affected arm in the shoulder.



Picture 27

Picture 27.
Inhibition technique.
Through the flexion of the trunk and weight on the scapula give this an inhibition of the tone and is movement in the gleno-humeral joint better possible.
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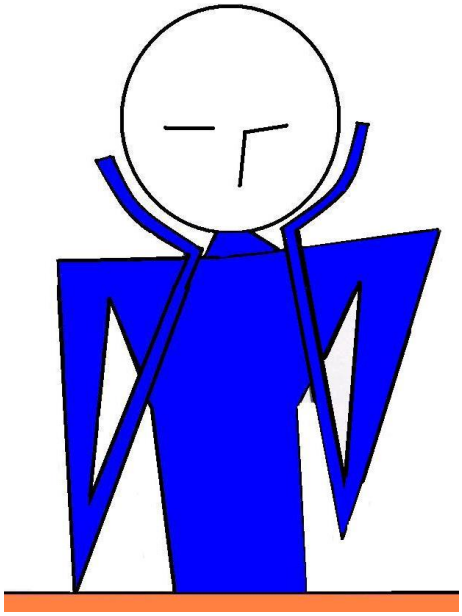


Picture 28

Picture 28.
Another inhibition-technique.
Placing the affected hand under the face and placed the elbow on the table . Create an pressure on the elbow with the push of the face on the hand because that will always give an upper trunk forward therefore flexion and activity in the front diagonals.
In the picture the not-affected elbow is all in the air to give more push on the affected side the decrease the tone. Holding this support with the affected side makes the not-affected side free for doing something. Read an journal ? But there is also an perception boost possible through the face and the affected hand. Often patient feel their affected "hand than on such an way that they recognize from before the stroke . This can give sometimes an emotional reaction, but gives always the perception an stimulation !!
Picture 28 published with the responsibility and permission of the author by j.v.d.Rakt.

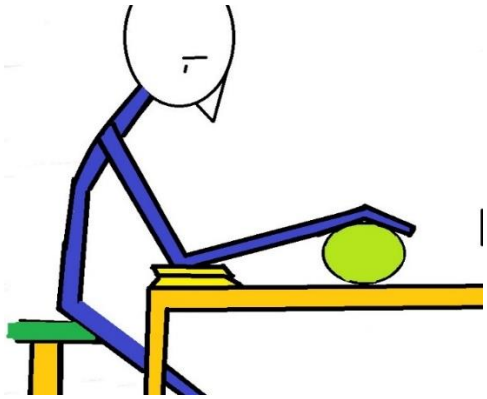
Important to give the individual after an heavy exercise an rest- and inhibition moment and make the arm/hand again ready for the next exercise. Too often work with high levels of tone will also give another perception and high tone will restrict the movement of the keypoint – shoulder.

Photo 14

Photo 14.
In sitting position holding an stick with sand (about 2 kilo) but there is an communication problem. He understand not all we ask and he has problems to let his hand do what he wants. He say often to his affected hand : "open ", but there is no release of the grasp. How create an environment that will ask another route in the brain. He was an banner man of the music corps and the task: " swing the banner" give an realize of the affected hand on the top, he going down to floor[48]. To lift the stich on an little crutch was easy without words. Sitting in front or on the side and do it, he copy the movement especially when the stick makes noise. To move the stick to the front , side way or back the noise of an car gearbox was enough to get this movements. The gearstick goes from the one to the two etcetera. Be able to create an situation that the individual knows and enjoys.
Photo 14 published with the responsibility and permission of the author by j.v.d.Rakt.

Picture 29

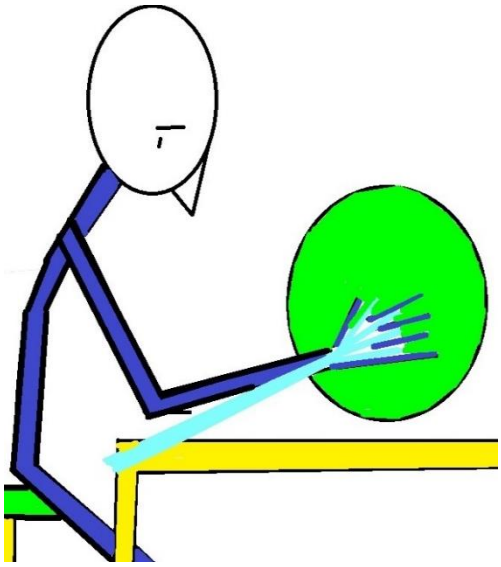
Picture 29.
Holding an box between two hands and now push with the elbows over the surface of two towels. Moving to the end of the table meaning extension with holding exorotation. The elements of the both movements synergy under control, upper trunk in flexion and active front diagonal make the elbow so straight as possible and lift the box.
Pull the box back with the upper trunk in flexion. Variation ; load other direction , rotation of the box with the affected hand on the top or – heavy- on the bottom.
Picture 29 published with the responsibility and permission of the author by j.v.d.Rakt.



Picture 30

Picture 30.
Playing with an little bal. Control first with the trunk in the good position and the elbow with an fixed point and move to front, left or right with the elbow, wrist and hand/fingers. Pressure on the towel and move the elbow with the movement of the hand.
The influence of the shoulder is increasing especially when the elbow is of the towel . To control is than the first task and then control in all joint and move further. Variation the table can be instable or standing up at the end. Or make the ball larger.
Picture 30 published with the responsibility and permission of the author by j.v.d.Rakt.

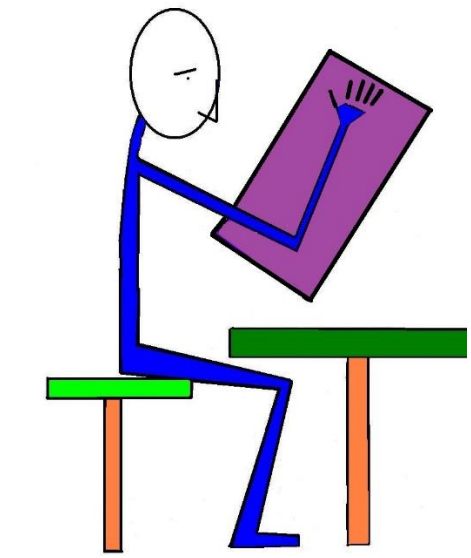
Support of the elbow creates, that there an closed chain and observe what the individual do with his not-affected arm. Normal he will create on that side also an closed chain and get an base that will support the front diagonals from the upper trunk with the keypoints – shoulder to the lower trunk with the hip as the keypoints. The diagonal must have an good stability. Photo 14 let see that the therapist create by placing his knee against the knee of the individual and stability of the legs and that can influence the possibilities of the front diagonal. Also make use of an extra closed chain point by pushing the table edge against the stomach. Picture 30, when the ball is on the end of the table, the movement can be further through standing up movement. The movement with the box or ball is an dynamic half closed chain and that means that there are more possibilities to different direction to move and thus more to controlled. When the elbow is from the table this closed chain is then also an half closed chain and there is an increase of movement possibilities. Important the individual must be able to do it because that will motivate him to exercise. When the synergy take control over the movement, he has an problem that he cannot fixed. That means no learning moment but also no moment of increase of power and coordination and an moment of disappointment.



Picture 31

Picture 31.
Catching an ball with two hands.
Variation is the most important rehearsal method to get better learning results (Differential Motor. Learning[17]). Catching an ball is an open chain that is difficult because the both hands must be equal and the focus is on the ball and cannot only be there for the affected hand. Therefore we create an chain (dynamic half closed) by taking the hand of the individual [41]and guide this arm eventually together with the not-affected hand to catch the ball. This is an technique of F.Affolter, with yours fingers between the fingers of the patient. This give an good inhibition of the tone and control.
Picture 31 published with the responsibility and permission of the author by j.v.d.Rakt.

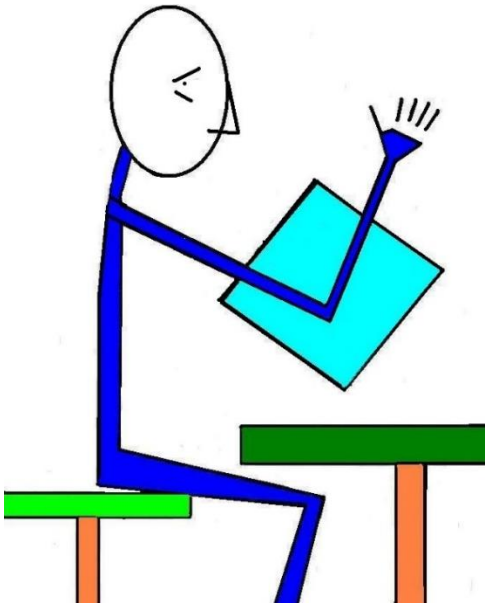
But by doing it together you will see that this possible and give speed and different situation.



Picture 32

Picture 32.
Lifting the arm will often be done with elements of the flexion movement synergy. Two element are often seen , the retraction of the scapula and that abduction and exorotation of the gleno-humeral joint. Therefore all exercise start with an upper trunk in flexion and that attitude will be hold as long as possible. Therefore the stomach against the table edge but there must be also an movement in the keypoint with no or little flexion in the upper trunk possible and that can be train with this exercise . This box with more load, create more need for power. Working with load must give an stimulus to the anteflexoren of the gleno-humeral joint. This attempt to get an isolated contraction of m.deltoideus .
Picture 32 published with the responsibility and permission of the author by j.v.d.Rakt.

Start with (picture 32) upper trunk forward, place the hand an elbow and be sure that this action is done well and feel the tension in the adductors (m.Pectoralis). When that tone is very high there will be no movement in the gleno-humeral joint and then is the exercise to heavy or the load to big. Is the individual capable to hold the box and lift him an little bit, thus moving in the gleno-humeral joint ask him to hold the box and make extension in the upper trunk without changing the arm posture. Sometimes it is necessary to lift together with the individual the box and ask to hold or gently lower the box down but try to hold the upper trunk more erect. The back diagonal will act but may never overact because than will there be elements of the flexion movement synergy occur. After that is possible, go for it, this box can up further in the front , can go to the not-affected side or affected side on the table but also to the floor, created an situation that will occur in daily life.



Picture 33

Picture 33.
Very difficult. Often it is better to start with two little box. And what we did by picture 32 can also with this two little box. Only one box between the elbow will focus on the adduction and exorotation and especially this combination make it often impossible to lift the arm with an upper trunk in flexion. Therefore this little box between the two elbows and lift hold the flexion , change the flexion of the upper trunk and try to lift further.
To lift the arm above the 90° there must be an extension in the upper trunk but also an further protraction in the scapula to place the cavity and the head of the gleno-humeral joint perfect. Of course the next step is between the hands and now make it an daily activity of it , from picking up and lifting on an high shell.
Picture 33 published with the responsibility and permission of the author by j.v.d.Rakt.

Picture 34

Picture 34.
An tin can is an perfect object to exercise the arms/hand. There is an relation with daily life, the shape of the can makes it possible to place the wrist and a the hand in an perfect situation. The variation are very high, you can start with moving over the table, with an towel, with only support of the elbow, with no support of the elbow etc. You can lift , turn the can with the affected hand up or not , do water in the can and exercise pouring. Load can be possible and movement up and total down are possible.
Picture 34 published with the responsibility and permission of the author by j.v.d.Rakt.

All this exercises has the purpose to activated the keypoint of the upper trunk. By using task-specific resistance treatment [25]there will be more power and coordination. That will be first in the exercise, there is than often no generalisation to other situations. Something that is for individuals after an stroke is very difficult, therefore make an continual item in all exercise program with an relation with the ADL. There are so many possibilities to give the affected arm/hand that progress an use in the ADL .
This will means that the use of the ability will be done every day and will increase this ability and that will lead to an generalization.

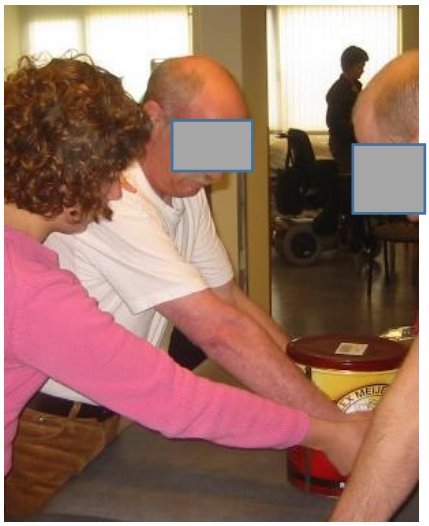


Photo 15

Photo 15.
In standing position working with the tin can with some load. The tin can is going down (eccentric keypoint action) with first bended elbows but the task is to set the tin can down with the elbow in extension. No assistance is necessary till the moment that the can is almost on the bench. Than the hand goes from the can first the ulnar side and even therefore the flexion of the fingers increased. Loss of this part of the hand (ulnar side) occur because the extension movement synergy must be an part to hold the can under control. That means that the load is too much and/or the extension is to large. Important is of the individual can hold the can of the bench with an bended elbow, because than he can still move.
Photo 15 published with the responsibility and permission of the author by j.v.d.Rakt.

The essence of the keypoint treatment is that there is movement/ control and that the muscles are working. That means that there may be influence of the movement synergy but no inhibition of the movement occur. Assistance is an option but the goal is without assistance and then is what flexion of fingers no problem.

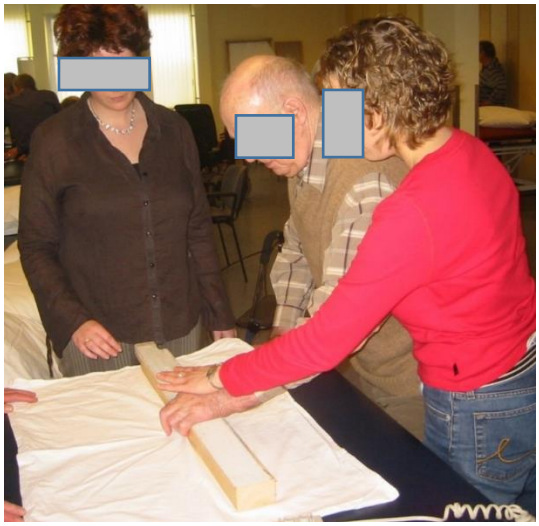


Photo 16

Photo 16.
To get control over the upper trunk forward and more tone and power in the front diagonal and make the affected hand ready of support but also support with movement . He hold with his affected hand an plank and with his stomach against the table he push the plank to the other edge of the bench.
To make gliding easy she use an towel, this will be an action for the protraction but also the front part of the muscle in the gleno humeral joint. To control the movement straight forward there must be an cooperation between the small muscle in that joint.
Photo 16 published with the responsibility and permission of the author by j.v.d.Rakt.

The hand on the back of the hand of the individual with an stroke (photo 18-19) is necessary but can be also give some resistance. This can give an good hand position and the individual the possibility to set more strength and that can increase his power and coordination. An translation to the ADL extension elbow with an upper trunk forward is important. An problem is often to get the affected arm in the sleeve. This ask for an good coordination of the arm in making an extension without movement to the right or left and totally to the end of the sleeve. The control visual is gone as the hand is in the sleeve and this ask another manner to control this movement.

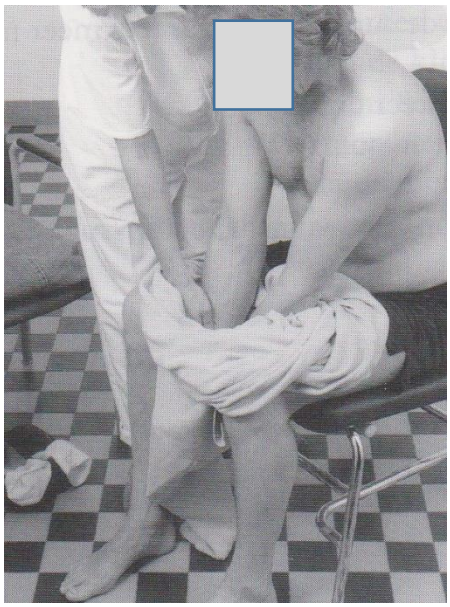


Photo 17

Photo 17.
Start with an preparation that the sleeve lies between the two legs and take the affected hand with the not-affected hand and push both in the sleeve. That is the start but try so soon as possible this movement pushing in the sleeve to the end of the sleeve do with only the affected arm . This is possible with an part of an extension movement synergy. But don't forget that this is only the pushing part and that the preparation is whole other- and difficult story. Therefore moving in to the sleeve must also be exercises in other manners. The reason that between the knee is easier, is because the movement can be done by the upper trunk forward.
Photo 17 published with the responsibility and permission of the author by j.v.d.Rakt.

But we want to learn and exercise the movement in sit and then make protraction and use an movement in the keypoint and control there to push the arm/hand through the sleeve. That means less preparation and more independency.

Photo 18

Photo 18.
Two student in discussion how to act.
The task is extension in the elbow but with the affected arm straight to the end of the table.
To do it first with two arms/hand is good and many individual will now better understand what the meaning is and feel how the perform with the not-affected arm. The towel is an little bit small but the elbow must go in extension . The stomach is against the table , what is the discussion about. The lady feel that the tone is increasing in the affected arm when he want to start and ask why that is ? Do you see it?
His not-affected leg stand more to the front and he start in that leg and stimulated the back diagonal and that increase the retraction and activated the flexion movement synergy in his affected arm/shoulder .
Photo 18 published with the responsibility and permission of the author by j.v.d.Rakt.

Photo 19

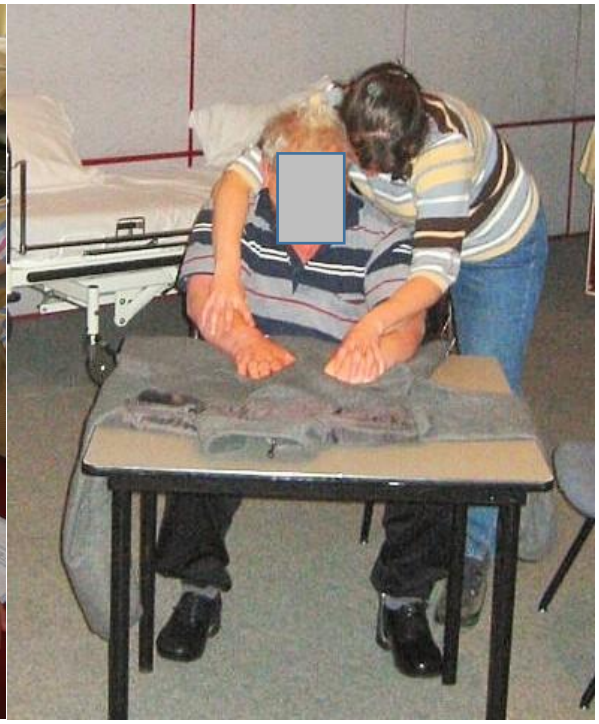


Photo 20

Photo 19 and 20.

19- the power against the edge is increase, there is control on the shoulder and hand and the not-affected hand is in rest. Push now in the beginning with an elbow in flexion that gives an increase of the protraction and then the extension of the elbow was good till the end of the table.

20- To give this capacity an place in the dressing, it is wise to do it together with the individual on the manner of F. Affolter [41](Tactile Kinetic Assistance- Guiding) and without verbal instruction go for an dressing of this sweater and solve the problems together with the maximum of effort of the individual.

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

Photo 21

Photo 21.
To get more control in the arm and especially in the keypoint and other example of the Guiding approach[41]. Holding an cucumber in his affected hand and with the other he try to relieve the cucumber of the skin.
That means that the cucumber will be move away and he must stop that movement with his affected hand. First in this position but after that with increasing of the extension in the elbow and far to the end of the table by the next cucumber. This cucumber and the skin removing is the task for him , that is the priority.
Photo 21 published with the responsibility and permission of the author by j.v.d.Rakt.

Conclusion.

Exercising for an decreasing of the influence of the two synergy's is very important. Of course is this important, when the shoulder –, elbow and wrist function recovery when there is an hand- function. That is the reason of the arm/shoulder to grasp and manipulated something and use the hand in all kinds of function in the ADL and IADL. But the hand function is very difficult to restore [49,50], but the negative prognosis must not brace therapist to get the best result from his treatment. That is true for the hand, there are investigator buzzy with robotic –arms but the result are poor and the cost are high . That means that only an few individuals after an stroke will have the benefit from it. But there are treatment possibilities that has influence on the hand function [41,42,43]. But with an poor hand recovery, there is still an whole arm that must participated in the ADL and it is important that when the hand has possibilities that the shoulder can provided movement to place the hand there where he must be. Therefore is exercising of the upper trunk and shoulder essential and it will be clear that the diagonals play an important role in that treatment.
The greatest mistake is to train in open chains because than is the only option;
"Use the synergy "!
That makes dissociation so important and that asked for an almost normal tone. Otherwise will the synergy only dominated and is the influence of other muscle pattern very little. Through the work of an lot of investigators [49] is the believe that treatment can change the possibilities in the arm/hand rehabilitation decreased and has many therapist not the ability and creativity to give an treatment that make this possibilities true. Certainly by individuals with an chronic stroke is an good treatment of the arm often very poor, even the inhibition after an balance treatment isn't often present and that makes the possibilities of the arm even worse. What we see is that chronic stroke patients have more tone and an pathological synergy in the upper trunk all away to the hand, but that not alone the tone is increased but also the tissues in the area are decrease in their mobility and make the performance of the arm poorer.
The next part will go on with the dissociation and look also to the possibilities of the F.E.S [33] , but let also see how we can decrease the tone and increase the mobility and create an better situation to move and work with the affected arm. Dissociation of the synergy and the translation in the ADL- activities are so important to obtain an good and steady result that inhibit the tone, hold the mobility and give pain less possibilities to occur.

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