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Diagonals Part 8 . Stroke 6

Analysis of walking pattern and treatment.

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Abstract.

The second part, that will go about treatment of walking after an stroke. We know that the science have found that the pattern of the leg muscle are "definitive" after an short time. Within an month is an pronunciation and some others find that too long. But we want to express that this pattern are only investigated by patient treated in rehabilitation center (in the Netherlands 10 -15% of the stroke population) and often on an treadmill or in an laboratory, not at home, on the street etc. Furthermore the muscles that were investigated are only the leg muscle almost never the spine and stomach muscle that could revealed the existence of the diagonal. There are muscles – the m. gluteus max. and med. that give another image(see part 7). They are an little bit present in first two measurement, than we see their appearance in the third measurement very well but in the fourth this appearance is somewhat lesser and in the fifth also. This is not an sign that walking pattern will change, on the contrary !! In Belgium there is done an investigation, what the value was of the swing of the arms when we are walking and that investigation had the conclusion that this was the most economical way to walk. In this part we follow two individuals after an severe stroke and we try to do an assessment. All elements must be assessed and then we try to give exercises in the diagonal and discuss the progression. Both individuals will be still have an severe stroke but the quality of live has improve in some way and that is where therapist are for !! (Jan van de Rakt, Steve McCarthy-Grunwald ; Diagonals Part 8 . Stroke 6 Analysis of walking pattern and treatment**.** Ita. J. Sports Reh. Po.; 2019 ; 6 ; 2 ; 1191 -1239 ; ISSN 2385-1988 [online] IBSN 007-111-19 - 55 ; CGI J OAJI : 0,101).

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Diagonals Part Eight Pathology

The Stroke patient , how we can train the diagonals to create an better result.

Introduction.

Analysis of an walking pattern is very difficult because we miss the possibilities to feel or you observation are correct. See that someone walk with too much extension in the knee can have an lot of different explanations and this explanation can be all be correct

Knee extension can be an part of the extension synergy, that the damaged brain have created to give the affected leg the possibility to bear the weight of the body, when the patient stand on the affected leg. That the perception of that leg is decreased, that is almost certain because an higher perception would indicated an less damaged brain.

Perception is an brain function, the input from the affected side, is be in the brain translated in an perception and that use the brain to give an motoric answer.

That motoric answer is that what the damaged brain can give. But the science have shown us that the pattern that they have seen on the EMG stay on the same level, but we say in part 7A that there are muscle that want to act but not have the possibility to give their contribution. Therefore there is an walk generator on spine level and an brain contribution that search for the best and the most economical solution, but they stay all in the brain system or we must find an way how to get this in the walking system.

One of the most important system is the balance because we say in Part 7A that this is very weak when an individual with an stroke walk. (90% against 10% by people investigated in an rehabilitation center). In my view this is wrong, you cannot say that 10 % of the stroke patient decided which therapy is good and which not.

There must be a much bigger difference between individuals after an stroke, some are able to walk after 4 days and go home or another individual that stay 1 month in an rehabilitation center or 6 month and goes home walking with an 4 leg stick or an individual goes to an nursing home and he achieve after 5 years to walk again.

The damages in the brain is always by every individual after an stroke different and the age, the condition before etc. is all different.

That means that only an good investigation of the individual will gives us the tools to create the best treatment. And especially individuals with an chronic stroke will need treatment the rest of their live and too often we heart that this is too expensive, but that is the approach “stop the treatment” and try to restore months later what than not too restore is .

We know it , why we do it !

Therapist and Science !

That means that all therapist must search for all kinds of treatment and that science investigated what the benefits are for which stroke patient and not what now is happening.

The scientist search for in an laboratory what are good exercises to test and investigated and that comparing with conventional therapy.

Nobody knows, what conventional therapy is. The scientist do his investigation often on treadmill, balance exercise in an corset, CIMT by people with an good prognosis, circuit training of activities that are possible for individuals that had an stroke and that makes the window so narrow that many individuals with an stroke are not interesting anymore for the physical therapist because the science has told that no recovery is to expect and thus is treatment not really necessary. The consequence is an decrease of the possibilities of the 90% not investigated individuals after an stroke and an loss of knowledge and acquaintance of physical therapist.

The science has now the wrong role they must not predict but investigated!

The individual after an stroke that we see in part 8.

We always search for 4 items, why this individual walks in this way!

1. Tone, that means active movement thus the selectivity, the passive movement the tone sec, the

structure of the muscle pattern diagonal and homolateral possibilities and of course, the strength , the power and the possibility of concentric or eccentric or reflex muscle activation (the answer of the level of the damages brain)

2. Perception, try to investigated what the brain can do with the information that is be given and how much of the continue flow is coming through.

3. What the reaction are of the joint, the muscle , the nerve, all structure on this way of movement . Alignment.

4. Balance , we must know, what his/her balance is in sitting and standing position and now is perception very important, because no translation of the information of the affected leg will never contributed with an better balance and is that an possibility to change.

Case one

Mister v. Z. has had a stroke now 13 years ago and he has difficulty to hold is level of performance. That has certainly to do with his condition and the number of cigarette but he develop an extension of his paretic knee that goes to an hyperextension.

He complaint that his knee hurt in the evening and that he has lesser problems, when he walk not so much. He walk very slow and every time, he stand on his affected leg, he need time before he place his not affected foot, but he never stop the movement complete. Well take he now and then an brace and support himself against the wall. We start the investigation and do an few test to see how fast he is .

1. **Tone**.

   Active movement /selectivity. Lying on bench we ask him to move his affected leg to lift it in the air, he is capable to lift the affected leg, but we see that he pushed his not -affected heel in the bench and then he can lift the affected leg with an movement flexion, exorotation and abduction in the hip, flexion in the knee and dorsal flexion with supination in the foot. To invest what his capacity is in regarding selectivity, we set the hip in flexion 90 ° with no adduction/endorotation or abduction/exorotation and the knee also in 90° flexion and the foot in dorsal flexion with eversion and ask him to take over this position. When the assistance disappear the foot goes in dorsal flexion, the knee he cannot hold in 90° flexion and the hip makes more flexion and abduction and exorotation. (Fig.1)

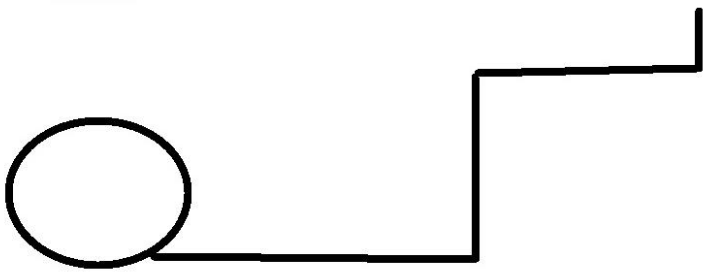


Fig.1

That means that his selectivity is on an pathological flexion synergy level. Lifting the not -affected leg, we feel not that the heel of the affected foot goes in the bench but we feel the fore foot makes plantair flexion with inversion. The knee goes in extension and the hip stay in exorotation, only an short movement is there in the direction of the endorotation. Almost no muscle activity in the muscle gluteus maximus.

That means that there is an extension synergy only the hip is the synergy not complete. (no clear endorotation) That means on the Brunsstrom Fugl Meyer (BFM) scale that he get an 3- 4.

The head placing is good but he had difficulty to hold the flexion exactly in the mid. He must work to correct that because the head want to rotated to the not-affected side BFM =5. Placing his trunk to sit position from lying is very difficult without the support of his not affected arm but when the affected leg get an support he was capable to do that but the greatest activity was on the not-affected side. Without the support on the leg, the affected leg goes in an flexion synergy when he try to initiated the movement without support of his not-affected arm .Activation of the front diagonal starting on the not-affected side (arm) and that evoke in the affected side trunk/affected leg an flexion synergy BFM = 4-5. The possibilities in his arm. He was capable to make the beginning of an flexor synergy but only what movement in the elbow about 20° flexion , not in the hand or shoulder but with an retraction in the shoulder blade and when he try to move his arm, he must look to it and he push his not affected foot in the bench. He use the back diagonal to evoke lift his affected arm and create the start of an flexor synergy The hand was flat and was after the stroke about 3 month very dick and that was not treated with an cock-up splint to restore the circulation and his shoulder had an sub luxation. BFM = 2.

- **Passive movement** The resistance were measured by the Modified Asworth Scale MAS scale . Head rotation and lateroflexion to the affected side = 3, flexion of the head was the tone slightly higher = 2 . Trunk movement – passive- the tone was when he was brought to an sitting position about 2 but the end gave an suddenly higher resistance and every time on the same spot fast increasing to 4, he has in the past suffer from back pain.

The arm , the fingers were almost not to move, there was an very hard end- feeling that not feel like tone but like joint restriction even so the wrist, the elbow was good to flex over the whole movement range, but extension gave an tone increase of 2 and at the end the extension in supination was not possible. The end position was not to obtain and hurts about 30° degree for the end but the end - feeling was still not hard. The shoulder blade there had an high tone that fast increase from 3 to 4 and therefore was it not wise to move the glenohumeral joint further than 90 ° and no resistance was felt , tone was 0 or even -1. The leg , in foot; The movement towards dorsal flexion was the tone increased and go at the end fast higher and there was no dorsal flexion possible , the end was hard and 4 , in the beginning the tone was 2. The movement stop with the foot still in some degrees plantair flexion (Stiker foot) Eversion also not complete possible and an hard end, inversion and plantair flexion only by fast movement an tone of 1.

The knee flexion has an tone of 2-3, but the movement was possible over the whole range of movement , extension of the knee gave at the end with flexion hip problems (pain) with hip in extension no pain and we could move further than the complete extension with no tone increase. Hip flexion only 1 by fast movement, hip extension problems when the extension was 10° but the resistance increased slowly from 2- 3, exorotatation much too far and no tone and it hurts on the end that was 30° further than the other side , endorotation increase at the end of the tone till 3 , abduction increase tone for the end till 4 and adduction goes without an resistance only with fast movement we feel an “jackknife” phenomena (fast increase of tone that was suddenly gone)

Thus there are tone disturbances, but there are other restrictions that has an different origin and that we discuss in the alignment part.

Diagonal. In the part active and passive movements, we have seen that the diagonal are affected , because he must have an firm anchor to lift his affected leg and arm, when he tried to get up from an lying position his affected leg goes fast in an flexion synergy. We have feel no buttock muscle activity, no heel pressure but well an plantair flexion of the forefoot when he lift his not- affected leg. But we do the test now with some load on the not-affected leg. We ask him to lift his not-affected leg and stretch it complete in the knee with 40° flexion in the hip, he cannot hold this !! The tone in the plantair

flexor of the affected foot increase and his not-affected arm grasp the edge of the bench and the head and affected shoulder-girdle goes in extension.

Therefore we placed the not-affected leg in 90 ° angle in hip and knee and that he can hold but now we give pressure on that not-affected leg and feel what is happening. We have immediately an great increase of tone on the affected side in the plantair flexor, little reaction in the buttock muscle, retraction in the affected shoulder with extension in head and grasping movement of the not-affected arm to the edge of the cough. He cannot hold an resistance against his not-affected leg. Resistance against the lateral or medial side of the foot against the not-affected leg show that his affceted leg wasn't capable to contribute. The leg move over the bench to what adduction. He has no back diagonal that start in his affected leg but in his not-affected arm!! Important now is to know of an concentric contraction of the m. Gluteus maximus is possible and also from the m. Gluteus medius and that wasn't possible with resistance against the lifted not-affected leg. The power that he make in the front diagonal going from the not-affected leg to the affected shoulder was less and the umbiculus goes immediately to the not affected shoulder and the affected shoulder was already in retraction together with the head in extension and the not affected shoulder. We therefore do two extra test to see or an concentric contraction is possible;

1.Tentacle test.

2. Lying on the affected side an move the not-affected leg to the front and back and of course we feel or there is an concentric contraction.

Photo 1 and 2 .
Photo 1 gives an example of an tentacle test that is ,beside resistance, extreme difficult and that is also the case on photo 2. But show how important in this situation the diagonals are. Photo one shows that the foot on the block is in exorotation because his other leg moves to the wall and photo 2 we see the point of the foot in the bench and the upper arm total to the back.

An tentacle test must be done with one leg straight (photo 1) but most individual cannot do this, therefore we let this tentacle do with flexion in the hip and knee and we ask to hold the hip in mid-position and lift the hip of the bench. Our person in this case cannot hold the leg in the mid- position and therefore we fixated the hip and ask him again to do that and he was capable to lift the buttock and we feel more muscle than ever therefore in the examination. Thus there was an concentric contraction possible. Lying on the side he could lift his not affected leg but cannot move it to the front because he had no control in the foot and shoulder and the homolateral action in the hip was present but the contraction was poor.

Strength, was poor in the diagonal back and front but especially in the homolateral structures and there was an domination of the extensor synergy in the leg and flexion synergy in the arm

2. **Perception.**

We do this test in lying position, be aware that now all cognition can go to the test and that is not the case when his is walking. Therefore when this test good in an lying position that this is not the same for the standing and walking conditions.

Propriocepsis:

He is blindfolded and the affected leg was set in an position and he must show by placing his other leg in the require position what he feel and interpreted in his brain about the position of his affected leg. Than when he has the position, he was ask to see what was wrong an correct that. We did this 3 times for the leg and three times for the arm /hand.

Hip difference was more than 25°and exorotation was never be felt and not see also. Knee more than 25°, foot was also more than 25 °.

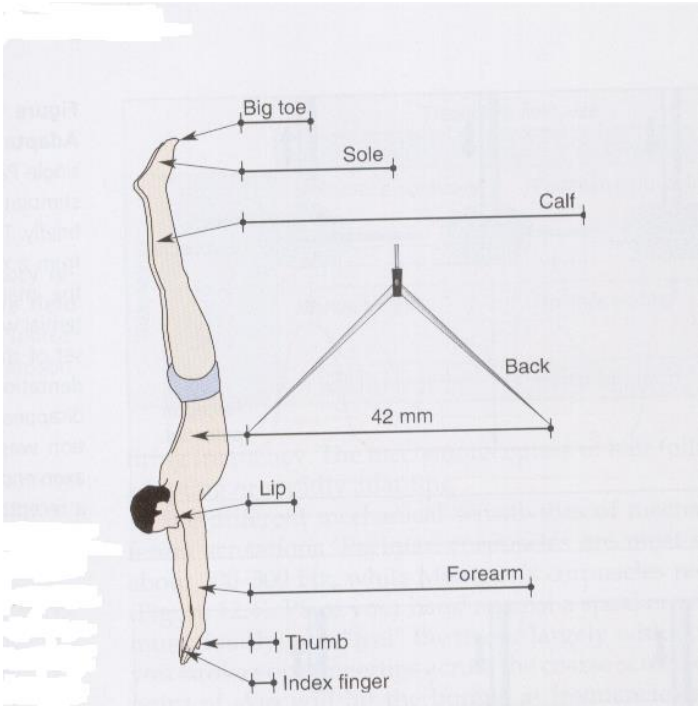
Passive movement with the affected leg to another position was felt but with an great delay. There was one difference when he started to copy the position of his affected leg with his not-affected leg

Propriocepsis ;
Normal must the difference for great joint lay under 11° and small joint under 4° difference .

he evoke by lifting the not-affected leg an extension (back diagonal) and was capable to an better result, but still 20° change in the hip and only for the extension and flexion of the hip. Thus he could use his muscle spindles in this lying situation.

Two point discrimination sense ;

We test with two pointed stick what the distance is that the patient feel two points with the eye blindfolded. We do this under the foot , under leg, upper leg , hand inner, under arm and upper arm, of course you can go further whit the trunk and neck /face etc. Under the foot was the distance almost the whole foot, thus one point at the beginning of the toes and the other on the heel. He taught to feel than two points. But with creating two point on the same time on both feet, he feel only one point on the affected side. This occur also when we gave pressure on his not-affected leg when we do the two point discrimination test under his affected foot. That means he feel no “movement” under his foot and the information will fast extinct The arm was even worse especially the hand inside. But there was an rear reaction, squeezing the hand and especially the fingers gave an movement of the fingers in extension and he felt no pain but very strange feeling in his fingers. Therefore always test or the sense for hard, soft, warm, cold is of some value for the perception and enter the damaged brain because you have an entrance.



Picture 1.
The distance of the two point discrimination sense.
Realize that we get this information ***continue*** when we are walking or sitting and that normal the distance under the foot is 3,5 cm.
We feel also the movement from lateral to medial under the foot, **he** feel no eversion or inversion movement. We can feel movement under our big toe but only by walking or moving the big toe . Look to the distance for the thumb and index finger on picture 1, the person of this case felt two point one on the top of the finger and the other on the **wrist**.

Vibration sense :

With tuning –fork, we test on bone part this feeling with the eyes closed.

I start often on the upper jaw on the not-affected side because an lot of patient don't know this sensation. And by all neurological diseases and especially by patient with dementia there are disturbances. Regrettable is that we were unable to lay an connection with which type of dementia but this were always bad walkers under the normal functioning level of their age in the Rilki & Jones measurements.

Testing by our person of this case, there was an great difference between upper jaw on the not-affected site and the affected side and between both arms. In the elbow , wrist and fingers there was almost nothing. In the leg start with big toe medial in the first M.T. joint no response , on the medial and lateral malleolus no response and on the tibia an little response.

That means, his perception through the vibration sense was not capable to recognize what is under his foot. Is it solidly, slippery, different etc. he must see that but cannot confirm that what he see is also correct.

We were always impressed after this part of the examination, that this people dare to walk !!

3. **Alignment** .
   Movement restrictions in the neck was partly an not right function of the vertebrae C6-7 and partly an asymmetrical tone between the two side. Treatment was only twice necessary with manipulation than he could hold the movement further by active movement. In the shoulder the greatest problem was the retraction of the shoulder blade, that has also an great influence on the sub-luxation, but there was an joint restriction in the elbow and an increase tension when we stretch especially the n. medianus. The nerve was good palpable behind the pectoralis muscle in the front armpit fold. Treatment of the retraction was now part after every therapy session and that improved the movement of the shoulder blade and decrease the sub-luxation. The restriction of the elbow was decreased with manipulation of the head of the radius and also through the "slide" technique on the nerve medianus tissue to get more movement possibilities in the elbow

and it has also influence on the hand, more mobility and more feeling and what reaction active in flexion of the fingers.
The trunk and especially the lumbar trunk was on the affected side restricted to lateroflexion and the S.L.R. was on the affected side about 30° lower, therefore here also “slide” technique and what tone - inhibition and - manipulation to get less tone and more movement.

– The hip has an hyper mobility of more than 30° in the exorotation with an end feeling what was very poor. Together with the poor power in the hip and the problem with the restriction in the dorsal flexion was this the reason that he develop an knee that had too much extension. The treatment will discuss in the part latter because this is one of the main problems.

– Knee extension was the end soft and we could 5-10 ° further than on the other side.
– The ankle has an restriction that was not total muscular or tone. but also was the stand of the malleoli together with the talus not optimal especially the malleolus lateralis and the splint that he had was not capable to braced the inversion. The treatment for the ankle was manipulation according Warmerdam/Mulligan, tone inhibition and an better support system for the foot/ankle.

Photo 3 and 4
Photo 3 show the splint he ware at that moment and photo 4 show the splint that we gave him because that splint was capable to hold the feet in an better position. The first splint give more pressure on the calf muscle and that increase the tone and could not avoid that the ankle goes in inversion and created an ankle restriction that greater was than necessary. Further he couldn’t get this splint on by his one. The splint he got has his entrée on the backside and that make it possible to get him on his affected foot without assistance.

Splint one is warring in an shoe and that makes it very difficult to get him on and that increase the tone and makes thinks only more difficult. Furthermore the possibilities in the shoe and splint to move still existed, especially the inversion and plantair flexion.
Splint 2 has two iron splint that sit on side of the under leg and is holding together with an iron peace on the front of the under leg. This makes it easy to get in the shoe without stimulating the calf muscle. To hold the ankle in the wright position there was an T- leather that hold the inversion back. Both splint help the patient to hold an dorsal flexion of the foot , but splint two has an spring that was able to hold the progression of movement toward the dorsal flexion in the affected foot.

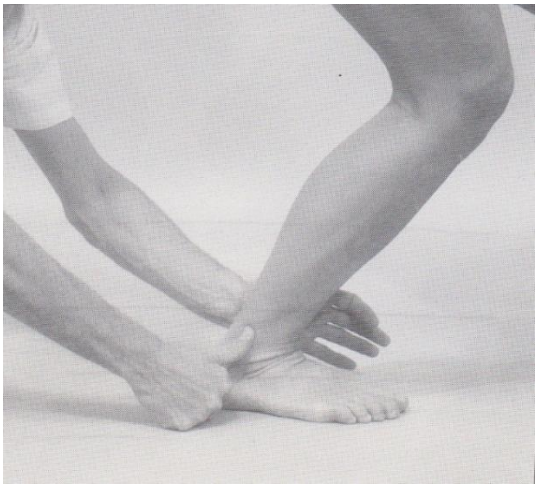


Photo 5.
Manipulatio technique according Warmerdam. Starting in most relaxes position but standing on bare foot and the individual stand for the bench. He must move with knee bended in the ankle towards the dorsal flexion and there was giving pressure on the malleolus lateralis from behind to the front and that increase the mobility of the ankle with no higher tension of the Achilles tendon.

4. **Balance.**

We examined the balance with two balance tests and an part of the sideways possibilities in an sitting position.
1. The " Statiek "test and
2. The one leg standing test.
Of course we do also the Berg Balance Test but that tell us very little about his balance only that he is dangerous for falling.

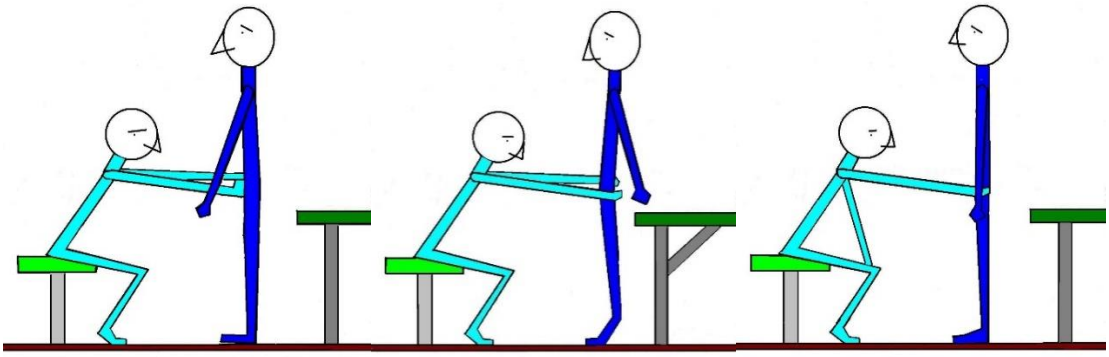
Statiek;

1. On hip high we ask to try to resisted the light pressure that we apply on the hip to the back, to the front and sideway.
To the front there was no possibility for him to create an resistance from the affected leg and on the not-affected leg this resistance was there, but always late. No one's there was an presetting , an movement before the pressure was apply. This is an combination of loss of power and perception, he feel himself more safe in an standing position more behind than normal and lesser safe when he moves to the front. He has created an new senso -motoric track.

2. On hip height pull him from the back to the front the resistance was very heavy and immediately, but almost everything was done with the not-affected site. There was "panic" when we try to created more pulling and then release this suddenly, he had almost immediately my shoulder with his not-affected hand.
This gives an picture of an senso -motoric track that is altered: He feel that he must stand further back than normal and his strategy was to grasp and replace the step strategy.
He was not capable to make an brake strategy, than weight bearing shift and the step strategy. The normal balance restore procedure !
3. Sideways on hip height gave on the not-affected side an firm and immediately reaction but also with an upper trunk sideways and that means that there will be never an weight bearing shift and step strategy possible because the affected leg will not cross but go away. Pressure on the affected side gave an very late reaction, we could push till he was capable to hold this pressure with his good leg.

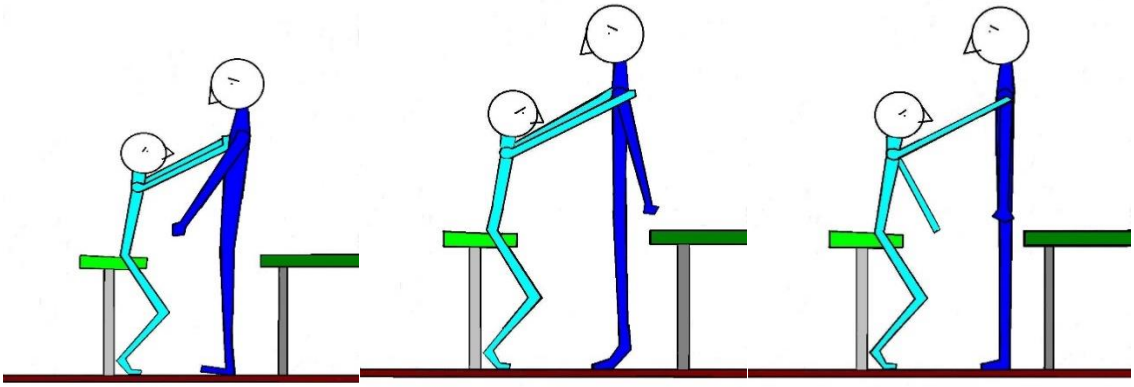
We also do this test on shoulder high because the bracing system of balance is an system of the whole body in which the trunk has an important role. When you receive an push from behind the trunk must go in extension for two reason ;

A. You can brace the falling movement and create time but
B. The movement of the leg that is free after the bracing movement goes to the front.
The pathological synergy movement answer also this rule.



Picture 2, 3 and 4. "Statiek " test on hip high. 1 – pushing to the back, 2- pulling to the front and 3- pushing on the affected side . more information about this test in the article Diagonals part one and two.

Picture 5,6 and 7 "Statiek test "on the shoulder level



On shoulder level.
The pressure on shoulder level:
1.He was able to counter that pressure on the not-affected side and after an number of repetition somewhat with the affected side but he did it with his upper trunk bending forward. The pressure that could build up was at the end quit good and he was not afraid. When I suddenly take the pressure away he did two things almost on the same time, his not-affected hand was on my shoulder and he placed his not-affected foot an little bit to the front. This is the only way he can counter an balance disturbance because when the weight of his body stand on his not-affected leg the affected leg should gone to the back. Now he was capable to create an back diagonal with his not-affected arm on my shoulder and his affected leg and was fast with arm and not-affected leg !
2.When there was an pull to the front he every time bend his upper trunk forward and the push back movement (extension upper trunk) came very late and first on the not-affected side and almost

nothing on the affected side. He was now less afraid and that is an sign that upper trunk bending is an part of the new senso-motoric track that he has developed. The power in the buttock on the affected side he wasn't able to build this up till in concentric contraction that gives an extension in the trunk. This muscle do his job when he was stretch and therefore he must do it with the not-affected side. Pulling and then suddenly release has now no significance, because the trunk is bended thus his affected leg will always goes to back instead to the front.
3. Sideways pressure on the not-affected side answer with an upper trunk sideway no elongation of the trunk but an spine shortening (senso-motoric track) and on the affected the pressure was answer by the not-affected side , thus the homolateral structure on the paretic wasn't able to counter the pressure.

1201

Very nice are this test, but more important is how he do it and when he is not capable how can we change that.

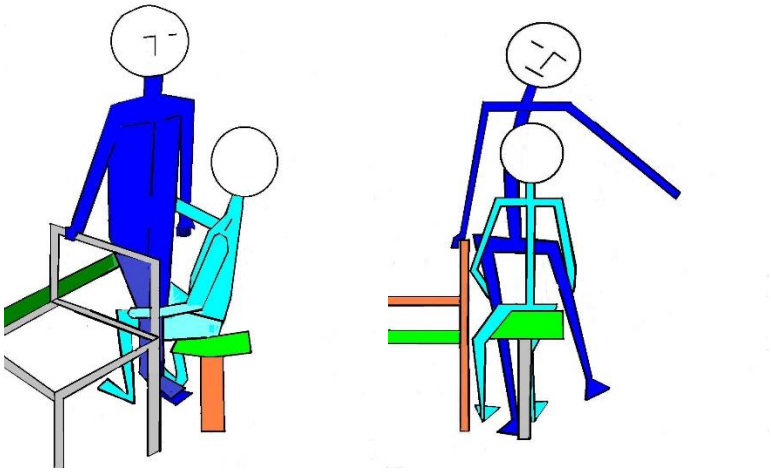
Conclusion: Another senso motoric track with more weight to the back and that is counter by an bending upper trunk and the extension of the hip/trunk was very poor. But we know also that the perception in the brain of the affected leg is very poor and that the strength isn't good.

One leg standing.
We use the classification from Monica van Eijk, because here test is more for individual after an very severe stroke and we have than what data what is possible and how.
1. Is not possible
2. With assistance
3. Less than 15 sec.
4. more than 15 sec.
After more than 15 sec. we can go to the normal one leg standing test.:
1. Not possible.
2. less than 30 sec.
3. 30 sec of more
4. 30 sec. with closed eyes.

Standing on the affected leg and lifting the not- affected led was impossible, but with an chair on the not-affected side and after some exercises, he could do it (diagonal) , but the homolateral structure were not capable to hold the pelvis and he was also not capable to hold the extension in the hip , the upper trunk came forward, he must stretch is buttock muscle to get an reaction and the knee goes in an hyperextension !!!

Standing on the not-affected leg was possible for 3-4 sec. And he make an upper trunk sideways. Immediately we train as in picture 9 to perform better. By training more standing on one leg, he feel what is happening and changes. This because, it was obvious that standing on his not-affected leg can improve on an very short time.
***Sideways in sitting position*.**
Sit on his affected buttock and cross the not affected leg over the affected was possible but go so far side ways that this become an balance exercises was not possible. The reaction of the buttock was poor. No strong reaction of the muscle and little exorotation. There was in the buttock area only little muscular function, but with an concentric contraction nature.
To complete the picture the other test are ;
10 meter walk test = 30 sec. 1,2 km/hour
Berg Balance Test = 36 /58
Trunk Control Test= 87/100 coming to sit on the bench he need assistance, he can do it on his one at

home, he said, but we take this element in our treatment.
Motricity Index(M.I.) for the arm = 9 and leg 33



Picture 8. Standing on his affected leg the therapist hold his leg and hip and lift the not-affected leg. The patient hold on an chair and create start of the diagonal starting from the not-affected arm. Now he could hold the position and experiences what it is to stand on one leg.

Picture 9. Holding on an chair and push the hip against it give now the elongation that is needed to lift the other leg , the therapist is helping with that.

Treatment.

We start with treatment with the focus on creating more power in the leg/ trunk. Therefore before and after every task specific resistance training was an session to mobilized optimal the neck, trunk , shoulder blade, shoulder, elbow and fingers /wrist , further the ankle and the nerves. Training further involves : on moving in and out bed, sit to stand , one leg standing after 6 month's even with some resistance against the not-affected leg and in the last 3 months we are starting with stair climbing.
He was mostly with some rest 1- 1,5 hour with us working and sweating.
Regrettable we have no photo from him when we start, but well an lot of photo's after 6 month's treatment, than he had his stroke for more than 3 years.

Photo 6,7 and 8.
Photo 6 start swing phase affected leg, Photo 7 end of the swing phase –heel strike. Photo 8 end of the standing phase on the affected leg with an passing of the not-affected foot of the affected foot. An see the knee isn't in hyperextension.

What is so special on this photo?

See how he make use of his diagonal especially the back diagonal to get the best and faster way of walking and that start with the cane position. In photo 6 he placed the cane for the stand phase of the affected leg qua position but he use him to get more movement in the affected leg. On this way the affected leg goes further as the position of the cane. Placing the cane gives an increasing of the tone in the front diagonal through the not-affected shoulder all away to the affected leg and created an firm swing. Photo 7. The cane stand now more behind the affected foot than we normally patient "learn" . And in 8 we see why, he push with the cane and created an total back diagonal force that give enough power and speed to make an movement over his affected hip. The position of the cane at the end illustrated how much force he apply though the cane in the diagonal. The trunk movement from the upper trunk is still there, lesser but present. To create an high amount on power in the back diagonal he hold the cane with an endorotation in the shoulder and makes at the end (photo 8) an movement in the shoulder towards exorotation to get all the power in that back diagonal. **The most brilliant creation is the position of his index finger together with the thumb.** He created now an position of the hand on the cane that abled him to let the cane become an part of the arm that makes extension (Back Diagonal) . We have never told him to hold the cane on this way, that was his one invention and many individual after an stroke will do this to get from the upper trunk on the not-affected side an perfect starting point for the back diagonal and so give then the best possibility that the other part (affected side) will perform better Much and fast walking with only that cane makes the not-affected shoulder vulnerable, therefore we train often with an Nordic walking stick or with the hand gliding along the wall or balustrade in the corridor. To create variation and different form of walking pattern and speed. (**Differential learning**.)

Photo 9, 10 and 11.
We have now on 9 the end of the swing phase and on 10 we see the loading of the affected leg and what is very good to see is the bending affected knee. And that part of flexion of knee stay, when the not-affected foot is set to the front. The position of the cane is now good to see point of the cane stand somewhat behind the heel of the affected leg and the position of the stick is oblique to the back and now it is obvious that he used the cane to push his weight over his affected leg.

The difference with the start of the training was that on the moment that the individual was loading his weight on the affected leg, he start with an upper trunk movement to the front and so elongated his buttock muscle. This elongating gives also an stretch on the hamstrings and then the knee will be extended and when that happen on the moment that he lift his not-affected leg, will that extension of the knee go with an certain speed and force. We see than an extension of the knee with often great force and speed that we lead to an increase of extension of the knee.
What we see on the photo's that the knee stand now in flexion and stay in that position to the whole weight bearing moment and is still bend as the not-affected is placed in front of the affected leg. There is still an bending op the trunk on the moment of loading (photo 10) but there is no extension of the knee. That because the buttock muscle makes now, after the treatment to create more concentric power , makes an concentric action is stead of reaction after elongation and stretch, than brace the possibility of the back side muscles in the upper leg pull the knee in an force extension. But how is it possible that the buttock muscle react on the right moment, we had achieve that by resistance against his not-affected leg but the problem is :"how he/we translated this action without resistance in his walking pattern".
That means, that the cane is necessary to create an better movement over the affected leg and that walking without is more difficult because this person in this case cannot activated the back diagonal without it.
To get it possible without an cane, we must try this by an activation though an force swing of the not-affected arm to the back on the moment, that load is increasing on the affected leg and that ask for an lot of balance and we now how difficult that is for an individual after an stroke when they are walking. But it is possible but that ask for much more tone in the buttock muscle and the muscle may not be longer by losing sarcomere in the period that he walks on the stretch stimulus. Because than will the muscle be too long to get on time with the concentric contraction. To create an situation that the loss of sarcomere is reversed, is almost impossible because than must the tone tension be high over 12 hours. (investigation of Tardieu, Goldspink) The only way is to create hypertrophy in the buttock muscle and that is very diificult.

Stair up.
Another exercise that will asked for concentric contraction in the buttock muscle is stair climbing. That was also very important for him because when he was able to do this on his one, his vacancy home in the mountains of Germany was only accessible by stair.
Stair up ask for power of the muscles and condition and to go down ask for selectivity and not too much fear, because fear will create an attitude that gives much upper trunk flexion and an pushing of the buttock to the back and now is going down almost impossible.
The attitude created to much of the body to the back and mostly ended this with sitting on the stair. But the are other methods to get down, you can reverse the technique upstairs for downstairs going, now the movement of the upper trunk to the front makes it possible to lift the affected leg and by flexion of the not-affected leg , he is capable to placed his affected leg an step lower.

The back diagonal will start by his not-affected arm /hand position on the cane and the placing of the cane.
Now the upper part of the back diagonal activated the whole diagonal and in this diagonal the partial activation of the buttock muscle is achieved.
Walking with an Nordic walking stick gave the same result but he was more afraid for falling.

Use of an 4 stick cane or without an cane, than there was an hyperextension of the affected knee.
The concentric action of the buttock was activated by the upper part of the back diagonal and the position of the arm/hand and the cane was his work.
He discovered this by his one and all patient will do so to increase the back diagonal when she want to walk over the affected leg and placed the not-affected leg further to the front and try to walk faster.

Photo 12 and 13.
Stair up and with facilitation placing the affected leg an step higher.
In the training we always try so soon as possible to walk on an "normal" way, meaning that never the feet stand on the same step. But in ADL we train all possible methods to go up and down the stair.

Repetition by variation !!

Photo 14 and 15.
The standing phase on the affected leg and the push from that leg to get the not-affected leg two steps higher. The facilitation technique is push with the shoulder of the therapist against the buttock and pull the to the front.
Further the hand above the knee stimulated the action of the knee extensors but also the movement of the knee (leg) to the front.

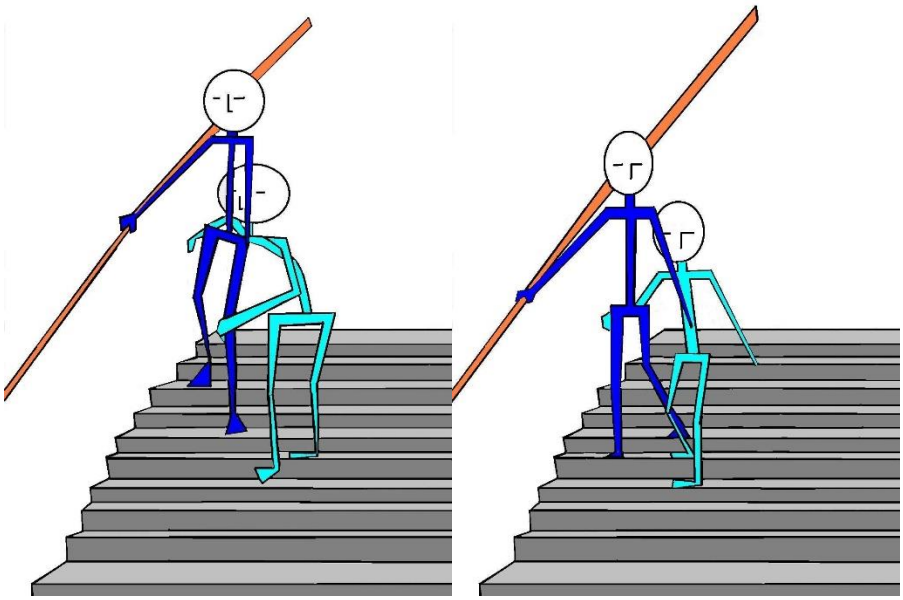
But in this case, we know that much activation comes from the upper part of the back diagonal. Therefore look to the position of the not-affected arm on the support of the stair. There is an increase on support when the not-affected leg goes two steps higher, the support is now the whole under arm but this arm is pulling on the support of the stair and that means an activation of the back diagonal and that will activated the whole diagonal when that is possible.

To activated the whole dorsal diagonal and in this the buttock muscle there must be an pulling movement of the arm be present!!

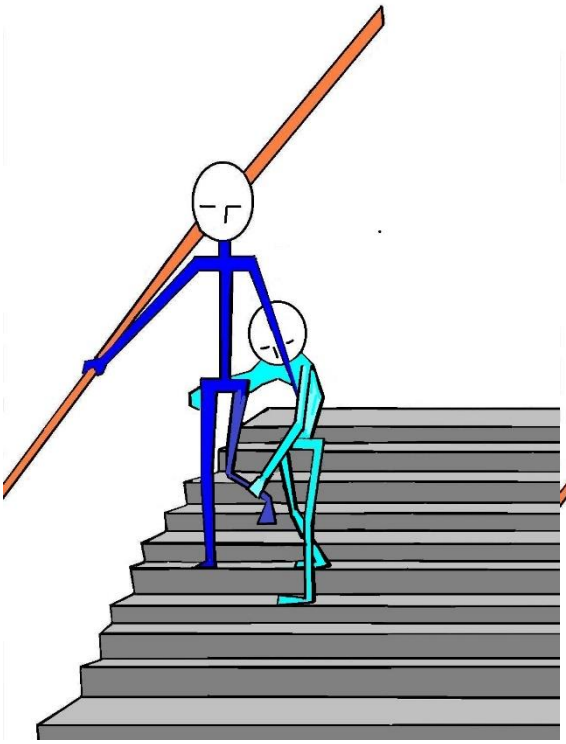
Stair down

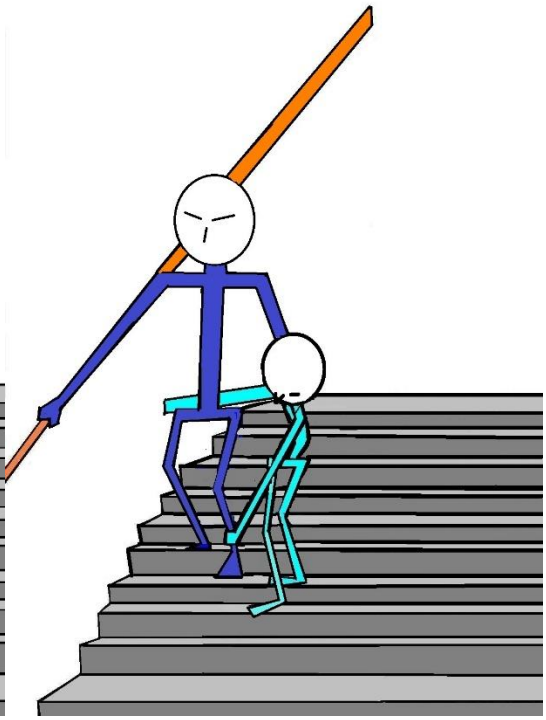
Problem 1 is ; That when we placed an foot one step down, we normally do this by “falling ‘on that foot. We hold our body straight and let go an catch our “fall “with the forefoot and then brace the movement. This is for an individual with an stroke very difficult, therefore we start with the not-affected leg and then placed the affected leg two steps lower. Now we see no “fall” movement, but an placing of the affected foot by bending of the not-affected leg in the knee and this bracing movement gives an increase in tone in the affected leg and the leg goes in endorotation and adduction together with the extension (extension synergy). With facilitation this is to brace and then is placing of the affected leg very important, because now the can be load on that leg and can the person try to get his not-affected leg again two steps down.

Problem 2 is; Dare to hold the body (the trunk and the hip) in extension and to step through and not stop because than the not-affected leg try to brace the movement and goes the hip and knee in flexion. And especially the hip flexion gives that the hip with the trunk goes too far to the back and stair walking is than almost impossible.



Picture 10 and 11.
Picture 10 gives an picture about the facilitation technique to set the affected foot/leg proper on the next step and avoiding endorotation and adduction but on the same time give pressure on the leg and push the hip to the front (holding the trunk /hip extension) to give the signal "walk through" Picture 11 give an image of the push to the hip and now stand the not-affected leg two step lower, now often we must help the affected leg to make enough flexion and to place the leg on the right way on the right step.



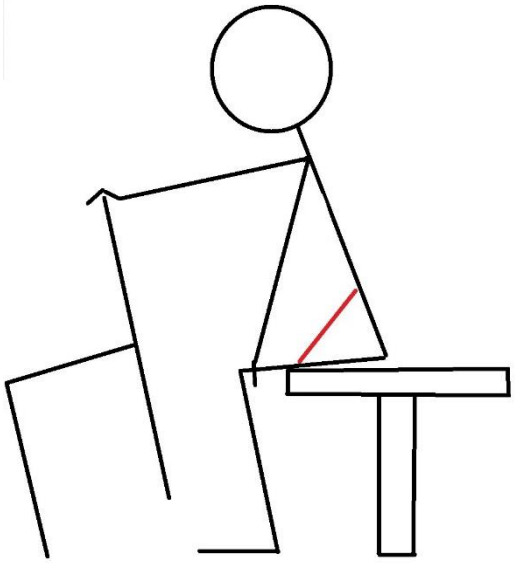


Picture 12 and 13.
Picture 12 gives an image how to help the affected leg to bend enough and Picture 13 the beginning of the pacing movement. The foot must we land on the forefoot but when the patient ware an helping device (Photo 2 and 4) than is this not possible and must the person make an landing on the heel and that means that he must make an longer "fall"

The base of the growing possibilities were the Task-specific resistance training.
- R.M. almost 75% and with increasing of the strength, still the resistance stay on 75% level because that is also increasing.
- three times ten and by 8 was the muscle fatigue palpable because he couldn't give the same force
- 2 times on one day and
- 3 times a week

Result were:
-Tone and selectivity no clear differences.
- Perception without muscle involvement no differences with muscle involvement was the perception better, he had than more control in feeling the movement of the affected leg , in the arm there was

no differences. The arm was not progressing, still he was more capable to dress himself because he had learned how to move the trunk to get the arm more in the front and that makes it easy to get his affected arm in the sleeve. (upper trunk forward position)
The arm exercise was now enter on support training and protraction of the shoulder blade.
At the end he was capable to hold an chair with his affected arm /hand.



Picture 14 .
He must hold the chair on two legs with his affected arm/hand.
That ask for an protraction of the shoulder blade and extension in the elbow. The base of his attitude was an upper trunk forward and created an extension synergy with protraction. More difficult is, when we ask to bend and stretch the elbow.
This is action of the upper front diagonal and he always put his not-affected hand on his not –affected leg . Because now he has an closed chain to set his body fixed and will there have more possible in the affected arm /hand. The chain is through the chair dynamic and that asked for more control than an closed chain.

Balance was better, he was now capable to stand on his affected leg without an great decrease of the pelvis with an slight assistance for more than 8 second.
The walking speed together with the disappearing of the genu recurvatum through the hyperextension of the knee was the greatest achievements he has reach.
His speed was 30 sec (10 meter walk test) that is an distance of 1.2 km /hour and this distance he was not capable to walk not because his condition was too poor, but he needed very much concentration to walk and that makes that he more energy needed than normal.
Now his speed was 20 sec and the distance he walk was with that speed almost 2 km. also outdoor.
Stair climbing also in Germany was possible on his one and that was very important for him and his whole family.
He was capable to bend and touch his feet and now he was independent on the toilet.
Still when we did an comparison than the picture is skinny;
- 10 meter walk test was 30 sec. 1,2 km/hour, now 20 sec 1,8 km/hour
Berg Balance Test was 36 /58 , now 39/58
Trunk Control Test was 87/100, now 100/100 coming to sit on the bench he need assistance, he can do it on his one at home, he said but we take this element in our treatment.
Motricity Index(M.I.) for the arm was 9 and leg was 33, now arm = 9 and the leg = 33.
But this man was very pleased with his progression and make clear that he going through with his exercises.

Case two

Mister J.J. has had a stroke now 2 years ago and he was independent in all movements as moving in bed, coming out of the bed, standing up and walking but dressing, washing he need an lot of help. He had stay more than one year in the rehabilitation center and was capable to walk with an 4 stick cane but he was very afraid and that was justly, because his wife reported that he almost every week ones fall. Till now this was always going good but both were very afraid that he will break an leg.
He ask for more power an confidence especially in his walking performance.
He couldn't climb an stair and sleep down in an bed in the living room.
Walking certainly outdoor and stair climbing up and especially down were his greatest wishes on this moment. He came to the department and talk with everyone when he was sitting in the wheelchair, he recognize other individuals that has stay with him in the rehabilitation center and was very social in his behavior, but that was totally change when he going to walk.

He got out the wheelchair but don't ask how he did this and grasp his 4-leg cane and walk with his head down very carefully to the bench. An distance that was about 11 meter. This was done with an concentration that was incredibly and he talk no more, react on nothing, only try to get so fast as possible to the bench.
About 1 meter for the bench, he stop walking and reach with his not-affected arm to support on the bench and "fall" on the bench. The danger of this approach lies in the stability of the bench, when that is not sable than he will fall for the bench. When he sit on the bench, he started to talk again, but his breath told us that he was exhausted.
This 10 meter he did this in **40** sec!!!!

Assessment ;

1. **Tone.**

Passive assessment first, because the attitude tells me that the tone will be high. And indeed very high in his arm but also in his leg. The hand was Mas 4 and also the elbow there was hardly movement possible , his shoulder has also an high tone shoulder blade Mas 3 and in an retraction status , this glenohumeral joint had an lower tone but the movement were restricted by the fixed retraction stand of the shoulder blade.
In the writing of the therapist of the rehabilitation center stand that this were contractures. There are many different ideas about what an contracture is but one thing must be clear !
High tone is to change, muscle shortening by losing sarcomeres is reversible, it make an muscle about 25% weaker but is to change. Restricted mobility in the joint especially under the influence of high tone is to change but very important is to know why the tone is so high and find an answer of the mobility will be equal with an lower tone.

Contractures are an irreversible movement restriction !!

That we may called contractures !!

Too often there was an contracture that was to treat and decrease, that means it was no contracture but an assumption and therefore no treatment !!
The tone in his neck and trunk was high, bending is head and rotated his head to affected side give an great resistance Mas 2-3, flexion of the trunk was difficult Mass 2-3.
His affected leg had high tone in adductor muscles and extension muscle of the knee and indirectly the hip Mas 3, the tone of the calf muscle was almost 4 and the toes were 4 and all toes stand in the claw position.

In the arm the flexion synergy maybe more an flexion posture and in the leg an extension synergy (posture). Low tone were in the endorotator muscle and abductor muscle and flexion of the affected hip with knee bend was easy possible, there was the tone only palpable when we move fast and then still not more than Mas 1.
When the knee was stretched than was the hip flexion possible till about 60 ° and that can point to an nerve problem.

MAS Investigation of the tone by passive movement. The speed is defined.

0 = normal

1 = light resistance at the beginning and the end of the joint movement (cut feeling)

1+ = light resistance over more than 50% of the joint movement. ROM = range of motion.

2 = obvious resistance over less than 50% of the ROM, but the range of motion is still total possible)

3 = Strong resistance and the passive ROM is difficult.

4 = ROM only partial possible

Active movement and selectivity.
He was capable in an supine position to move his arm in the shoulder further with the remaining of the arm in the flexion synergy(posture) that he had when he stand or walk, but then there were no possibilities to change the synergy only increase. The same with the leg, he lift the affected leg in an extension synergy but was not able to change it an flexor synergy and he must push very hard with his not-affected leg in bench and had pain in his back spine. His tone of his stomach was very high on the not-affected site but on the affected side and especially lateral the therapist fingers till the metacarpal joint get under the ribcage and the umbilicus stand to the not-affected site.
No selectivity and no active movement outward the synergy was possible.
Diagonal
Testing of the diagonals in supine position and side lying and remember that is total different from standing but we want to know how the diagonal works to translate this later to the standing position. Two methods , test with resistance on the not-affected arm or and that is the heaviest way with the not-affected leg.
The not-affected arm in 90° anteflexion straight up to the selling and the force is pulling the arm out wards but also pushing him inwards.
Pulling outward (the arm) ask for an action in the front diagonal from the not-affected side to the affected side and previous and stabilization act of the back diagonal from the affected arm to the not affected leg. By this individual the action of the not-affected leg was there, but very limited and the action of the affected leg was flexion also limited with almost no endorotation and the resistance that could give on the arm was low.
In this lying attitude his stability was poor.
Pushing the not-affected arm inwards ask for an action of the back diagonal on the not-affected side that goes to the back diagonal of the affected side and ask previous for an action again of the other back diagonal, both take care of the stabilization but the force that he could resist was low, he had no fixation on the affected side, no extension in the buttock, an little bit adduction, no endorotation but much plantair flexion in the affected foot but no pressure under the heel. The lower part of the other back diagonal was working hard but there was also difficulty to hold the foot in the mid position. Both side had trouble to create an correct stabilization
Was there more at stake than "only" an paretic side after an stroke ?
Ask him to lift his affected leg was impossible , the leg came of the bench but stay in an extension synergy and he push hard with his other leg(not-affected) and pull hard with his not-affected arm. The

affected arm makes more tone in an flexor synergy (posture). Lifting the not-affected leg and feel how well the stabilization was formed by the affected leg: He need to lift the not-affected leg immediately to an fixed point almost by his not-affected arm with no stop because that the leg fall back and he must start again. There was no action of the buttock muscle, little adduction and much plantair flexion but little pressure under the heel in the affected leg Resistance on the not-affected lifted leg was very little and only possible in the end position. After that resistance he must lay down immediately, but then I feel what action of the m.gluteus max. but the most action was in the plantair flexor of the foot and the adductor of the upper leg. The pressure under the heel stay zero .

Summary; Little almost no stabilization in the affected leg and much need of the upper part (not-affected arm) little endorotation (alignment problem?) and the not-affected leg was also not good in the stabilization of the body (alignment problem or more ?)

1212

Tentacle test and side lying on the affected side and movements with the not-affected side to see what the homolateral possibilities were.
Tentacle without support not possible.
He cannot bend his affected leg on his own and when that leg is bended by the therapist, he can make an bridge, but when he try to lift the not- affected leg, the affected leg goes into exorotation and in extension through the extension synergy. Therefore with am firm support he can make an bridge and lift his not-affected leg but only because his affected leg is heavily supported.
That means that the therapist must not only controlled the exorotation but also inhibit the extension synergy.
But was there was an buttock action –concentric
There were signs of static reaction. The T.L.R. was sometimes positive in the lying position and cross stretch-flex reaction, when he lift his not-affected leg, than it was almost impossible to bend his affected leg in the knee.
Side lying on the affected side. He don't like this, he never lay on that side (This is important to change because lying on the affected side is an great stabilization action and an perfect treatment item).
But I understand very fast why he don't like it, the control of the affected side was minimal. His affected arm give no support and he was only able to lift his not-affected leg, when he grasp the edge of the bench with his not-affected arm and the therapist must stabilized the affected leg. Otherwise he will fall out of the bed.
Summary; very clear that the affected side -distal part of the back diagonal- has very little possibilities to do the job.

2. Perception.

Propriocepsis was very poor.

An heavy and high tone, no selectivity, also all joint in the end standing position, very afraid when he lie on his affected side, what will his perception be of his affected side ?

Without visual control he was not capable to "feel" the stand of the joint always he gamble in which position the joint stand and always there was far more than 11° for the great joint and also more than 4-5° for the small joint. The worse it was in the fingers /wrist /elbow and toes / ankle /and knee, but the hip and shoulder were an little bit better but still far from the 11 degrees. With visual control he was capable to correct this but it cost him an lot of effort only by visual correction it was possible.

Two point discrimation.

In the hand was this very difficult and at the end he feel one point in his palm of his hand and the other almost at the beginning of the elbow. Imaging when he not use his eyes , he don't feel the sweater goes over his hand to his elbow, he must always look where is the sleeve on which point! On the foot sole it was impossible to create two point , the whole foot was only one point . When I tries to create an second point on the under leg, he don't feel the first point anymore (extinction). But at the end we have two points: one by metatarsalia one and the other on the under leg about 20 cm above the malleolus lateralis. This test also done on his not-affected leg and there were two point possible on the foot sole but also much too big. Normally is 3,5 cm the distance but by him it was more about 4-5 cm. That means that there was also damaged on the not-affected side.

Vibration sense. First tested on the jaw on the not-affected side, to let him feel what he can expected than on the affected jaw and then to the arm and leg on bone protrusions.

1213

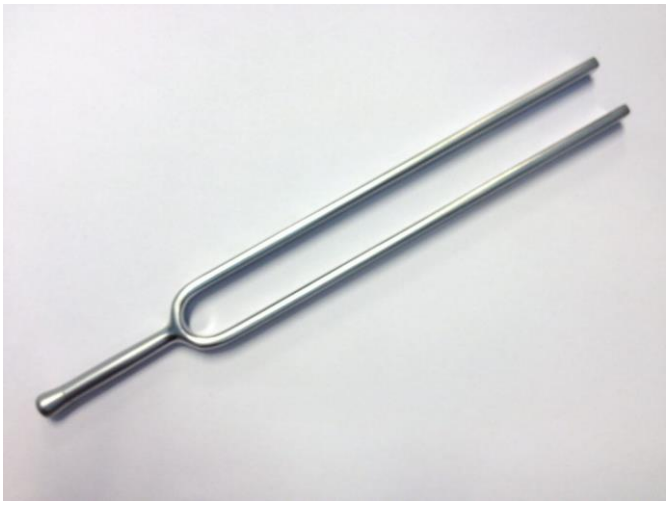


Photo 16 .
A tuning fork from 128 hertz but 64 hertz say someone is better. You test with this tuning fork the gnostic sense. The knowledge what you feel !!
We see that the ground is shining and think that he is slippery but only with our gnostic sense we can feel that it is slippery and that we must be careful. He only see that it can be slippery but never feel it !!

In the arm the elbow joint part, the wrist the ulna bone fingers the metacarpalia, in the foot the metatarsalia especially one, the malleoli lat. and medial, caput fibula and ask to compare the feeling with that what the feel on the jaw.
Than no visual possibilities and do it, with this man I go every time back to his not-affected jaw because even his jaw on the affected side was different There was also an difference between the not-affected jaw and the not-affected foot. I test also the tactile sense of his not-affected foot and there where places that where different with other and not only in head area between toe one and two but also in the foot sole and even in his under leg. And that could be an sign that there was in the not-affected leg an paralysis.
Is it an brain damage or an nerve problem periphery?
The test that we will do is the I/T curve test, to see what is maybe can be. There rest of the vibration test was that he feel something till his elbow but below nothing and in his leg nothing maybe what on the caput fibula but certainly nothing from his ankle or foot on the affected side. The picture was therefore very , very poor!!
Muscle spindles. You can test this with an vibration apparatus on an working muscle and you see than that this information is gone. Par example (Dr.Henri Kiers) did this with person with spine problems on the back muscle when the standing on an cushion and that gave an disturbances of their balance. Another approach is (not totally exact) is to move with both arms or legs and ask for the same movement and hold that position for time. Often you see that the individual after an stroke search for an possibility to create an closed chain by closing the arm or the feet against each other and so feeling where the affected arm /leg is. This isn't the purpose of this test. He can now use his muscle spindles system to "feel" where his arm or leg is but of course the possibilities in which the affected side can move is limited. But by moving both arms we try to investigated what the contribution is of

the muscle spindles of the affected side and see or he is capable to feel the differences between the position of the affected arm/leg and the not-affected arm/leg.
In this case this was not possible because he couldn't move his affected arm or leg and he only search with his not-affected arm/leg where his affected arm and leg was.
Therefore on the end of the examination we cover his eyes and ask him to grasp his affected arm by his hand, he must search and started at the level of his shoulder and goes than below. The same question but now for his leg , now he goes to his affected knee and then below. We ask him to try and touch his affected foot directly , he was surprised that is was zo difficult. The projection in his damaged brain of the foot on the affected side was gone !!
The conclusion was that his perception was incredible bad and it was an miracle that dare to walk !!

Alignment.

1214

By the assessment of the tone there where so many restriction of movement that an alignment investigation is very important and further one "what was the reason that his perception on the not-affected side was lesser. Where this restriction contractures or where the other reasons .

He has lie about an half hour on the bench and never say we a movement from his not-affected arm of leg to the affected arm or leg and that means that <u>his brain don't ask</u> for this information .

Look to your neighbour and watch how often he moves with his hand and feet because the brain ask for an <u>continue information</u> to now where the hand or the foot is !

<u>This was gone by this individual after an stroke !!</u>

Tone was clear one of the reason but there was also shortening of the muscles especially in the neck on the not-affected side, the trunk on the upper part of the not-affected side, in the scapula and thus upper trunk affected side , in the elbow (flexor and pronator and little bit supinator), the wrist both side and the fingers flexor, all muscle shortening ! The hip in the flexor and adductor- muscles, the knee the flexor- muscle and in the ankle the calf muscle and in the foot the muscles under the foot and the toe flexor. That is an combination of smaller sarcomeres and lesser movement possibilities of the not-contractile element of the muscle (cross- linked effects) This isn't irreversible , treatment with casting can this change but the antagonist is often also affected. There we see an elongation (caused by an change in the number of the sarcomeres can be the reason) and the result is that dependent what can be obtain in restore the power in the antagonist. Tone can also change the moving possibilities of the joint and then is it possible that the joint part cannot make the movement because the tension of the muscle don't allow this. We say by casus one that the talus cannot move properly thought the furca malleoli and that an correction give an better movement, but there was the tone not so high and the selectivity higher. We started with his neck and with the technique of Mulligan we achieve almost an normal movement with an lower tone on the not-affected side but the question is how long will this stay so when he is walking again. The answer was very short but it was possible to hold that when he could improve his walking with lesser tone. That means that this must be done **every treatment till his walking has improved** but he benefit from it when he start to walk because

he had more vision. His scapula was very difficult to release and this will be an treatment that will be combined with lying on his affected side and that he must still learn !

Photo 17.
Mister J.J.
During an walking investigation on the University of Nijmegen to investigated what there can be alter to walk better.
Unfortunately the photos are not great but you see the head stand, the elbow posture and the leg and foot and ankle fixation.
This fixation was huge, the shoe was build up over the ankle and in this was an EVO that fixated the whole ankle in one position.
But the tone was so huge that there was always movement in the foot toward plantair flexion and inversion.
He always look to his foot and take time to created load on the affected foot.

Elbow , here was with manipulation according Mulligan more mobility to achieve and the tone was what decreased. But what count for the neck, will count for all mobility improvements, that when he walk the tone is so high that the joint get back in the “wrong” position. In all joint was increase of the mobility possible but that must be every time because this will be gone. Still the amount of time to restore was lesser after several months of treatment.
That means that the contractures were not so permanent as the other therapist reported.
Another problem was his back, the movement was restricted lateroflexion to the affected side and the S.L.R. (Straight Leg Raising) was restricted on both side.
On the affected side was 60° and the end was very hard and the nervus ischiadicus was palpable in the knee cave and by pressure painful.
On the not-affected side was the mobility somewhat more till 70° but the end was also very hard and the nerve was palpable and he complaint over tingling in his not-affected foot. This was also the case by the Slump technique and when the head was flexed , he feel the tingling in his not-affected foot. Further was the position of the arm in the Slump –test when the head is flexed with more flexion and retraction and the nerve medianus was palpable in the axilla.

That means that the is an lot of tension on the nerve system also on places in the spine and that can have an influence on the tone and the mobility of the vertebrae, thus is it important to try this tension to decrease.

Because there were so many signs that on the not-affected side are also problems, we decided to make an I/T- curve . An old assessment that has similarity with an E.M.G

The I = intensity and T = time. By giving rectangle electric current with an increasing time and intensity (m-amperes) till we see that the muscle contract we receive an curve that tell us of this muscle has normal nerve conduction and or there is atrophy. But when we make the electric current triangle than will an healthy muscle be capable to adapt and see we no contraction of the muscle at the same point than by the rectangle test, there is now more electric current (m-amperes) need to get an contraction and that means that the line will go up instead of stay the same by the rectangle electric current. Now is an paretic muscle not capable to adapt and then we see in the test that the line goes down instead

going up and can we see how much and how severe the muscle/nerve is damaged. Further we can see of this is on brain level or lower , thus central paretic or peripheral paretic.

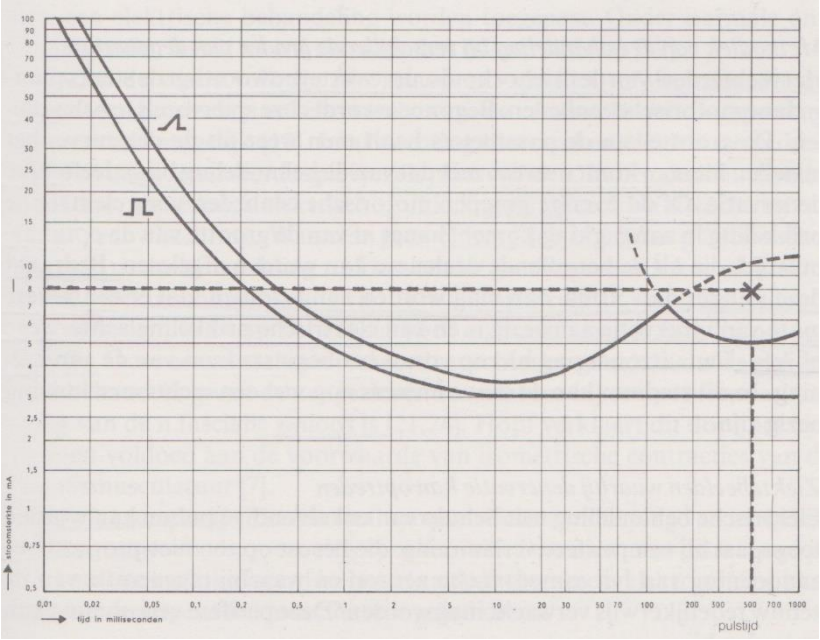


Figure 1. Normal I/T . In the horizontal balk we see the time that is increasing from 0,01 till 1000m/s. In the vertical balk we see the amount of electric current in m/ a (m/ampere)The reliability of this test is reasonable good. Test with E.M.G give always an confirmation from what our conclusion were . Certainly when it concerned an peripheral parese.

The curve with rectangle electric current:
The picture that we see, is that from 10 m/sec the curve makes no movement that because the muscle will react at 10 m/s even when there is an time or 50 m/s and 100m/s. The triangle electric current we see that this curves lies higher , because we need more electric current and the curves goes up between 10 and 20m/s. Important is that when there the change start, lies that change further to the right - par example after 50 m/s- that there is something not correct and can be the whole muscle paretic or for an great part .
In figure 1 we see at the end an dip that means that there is an part of the muscle that is not capable to adapt and that create an small curve in the great curve. That means that an part of the muscle has no good innervation through an the nerve. It is peripheral because the difference between 1000 M/s rectangle and 1000 M/s triangle is 5,2/3 = 1,7. (A. C.)
This is called the accommodation quotient and that is normal between 2,5 and 6/, when this value lies behind the 2 give that an indication of an peripheral paretic muscle part. When the value is 6 or more than we must think on damage on central level.
ùWe can also count the *rheobase* and the *chronaxie*. *Rheobase* gives us an sign of atrophy and *chronaxie* gives us an picture about the conduction of the nerve. Rheobase is in figure 1about 3 M/a that is good for this muscle (m.Tibialis anterior) and the chronaxie (figure 1)is 0,2-0,3 and that is also very good.
Thus the conclusion of this example is: That there is an piece of the muscle paretic but the remaning part is perfect, this picture we seen by people how has suffer from an hernia.
We tested by case J.J. the following muscles;
The muscle extensor hallucis longus
The muscle peroneus longus
The muscle gastronemicus
The muscle tibialis anterior
All this muscle give signs of paretic elements with often much atrophy and lesser conduction of the nerve and all this muscles had an part that was paretic.
That means that the balance performance of the not-affected foot was lesser through two problems:
1. First the foot , no great dorsal flexion to inhibited an fall to the back , no great plantair flexion to brace the fall to the front and also less power by fall sideways.

But Kiers has also investigated that spine problems will have an reaction on the balance especially when the ankle is instable or stand on an instable surface.
2. Second the perception of the not-affected foot was also lesser than normal. That means that the not-affected foot cannot dominated the balance as normal is by stroke patient. When they stand is the difference 60%-40%, but by walking is that 90% -10 %, still the not-affected side will do very much but will be very fast tired and that makes obvious why he is exhausted after only 10 meter.

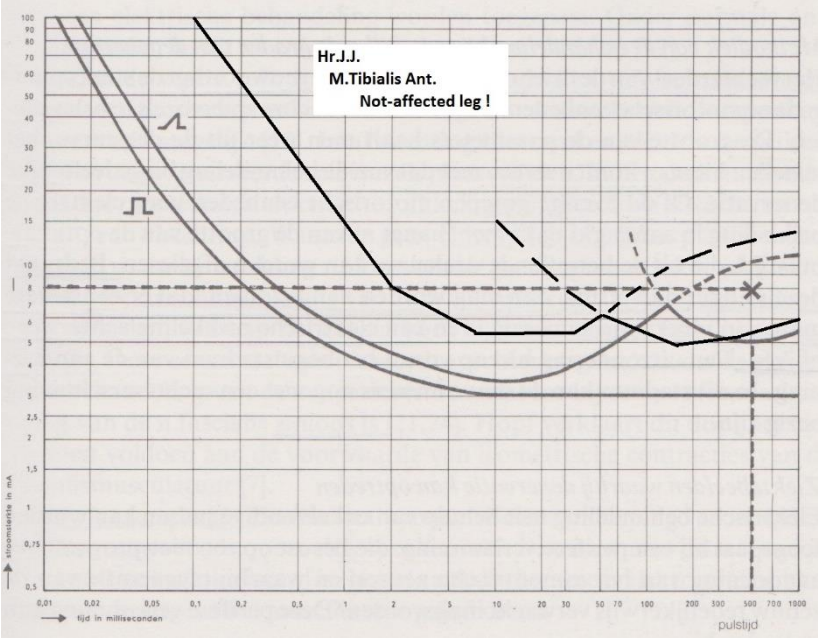


Figure 2.
This is an combination of figure 1 (normal) and in this figure we have drawn the curve of J.J..
This is the I/T curve of the tibialis anterior but the other muscles gave the same picture. Only the muscle halluces longus gave an worse picture. The base drawing (figure 1) was from an normal m.tibialis with an small part paretic.

What we see;

First the curve start further to the right and the turning point is very long over 30 m/sec. and after 50 m/sec goes the curve down till 150 down and that slight up. That means that comparing with normal there is more atrophy and the paretic part is larger. The muscle has an paretic part and the remaining part isn't very good (rheobase 5,2) chronaxie is larger than 1 and that means that the conduction of the better part is to slow and to little. It is peripheral because the accommodation quotient is about 1.8.

Alignment : Last item was the exorotation of the affected hip. There was an increased mobility and an soft end position but only with the hip in 90° flexion was the possible to assessed, with the hip in 0° there was an more end resistance by the high tone of the adductor muscle.

Balance Test are ;
1. Statiek
2. One leg standing and
3. In sit position crossing the leg and try to balance on one buttock.

Statiek.
Pressure on the hip to the back give an reaction of the not-affected side but none on the affected side, he know exactly that he was out of balance and give the right pressure back but increasing was almost impossible. The affected side don't react and the not-affected side react but the power was limited. Pressure on the back gave the same picture, the not-affected side react on time but the affected side give no reaction and the power was somewhat better than before but still limited. Pressure on the side on hip level an the affected side was react by the not-affected side and pressure on the not-affected side was there immediately,but again the power was limited. Pressure on shoulder high was difficult, he was afraid for this exercise and had his upper trunk in flexion

before the pressure was given. He knows that he cannot resistant the pressure when stand straight and therefore he bend his trunk and the amount of pressure that he could resisted was almost zero. And almost all activity came from the not- affected side but now there was an little contribution of the affected side.
Pressure from the back to the front was answered by him through bending the trunk to the front and then build up an resistance and now there was also what activity from the affected side and with the upper trunk bended 30° there **was an activity in the m.gluteus maximus on the affected side.** For the first time there was action in the m. gluteus maximus after an stretch(bending the upper trunk) but the power in the buttock increased without further bending and that **look like** an concentric contraction.
Pressure sideways was on shoulder level the same as on hip level, the difference here was that on hip level he did it with an elongation of the not-affected spine on the shoulder level he did it with the upper trunk movement.

Pressure on the affected side was only counter by the not-affected side.

One leg standing.
On the not-affected side he can do it but lesser than 10 sec. and then only when he stand along the edge of the bench but with no assistance.
On the affected side he need much assistance and was not capable to hold the pelvis straight. An sign that the homolateral structure on hip level was not there (m.gluteus med.) and the action of the muscle was only after stretch of the muscle.

Sitting on the buttock.
He was capable that to do for more than 20 seconds on his not-affected buttock with no assistance and with an elongation of the spine, he show that this was for him easy and that means that his perception and power of the not affected hip was very good.
Sitting on his affected buttock with his not –affected leg cross, was possible but very short and the pressure he gave with his not-affected leg was very high. When the not-affected leg was tilt by the therapist he collapse and couldn't hold the position anymore, therefore the contribution of the not-affected leg was very high through an cleave technique of the not-affected leg on the affected leg.

Klinimetric
10 meter walk test = 40 sec. and only 1 time than rest and he did the second run and then rest and the third.
Berg Balance Test = 27 /58
Trunk Control Test= 75/100 turning to the affected side was not possible
Motricity Index(M.I.) for the arm = 9 and leg= 18

Summary
It is an miracle that he can walk and is independent in all the movement that he must make through the day. But more than that isn't possible because this ask everything of him, but make him – as he said - an little boy that must be wash and dress by others. And especially that his wife that often did was for him an disaster but also for his wife, there were about this subject many hard discussion between this two. The only way to get this changed, is to try to create more power and balance so that he is capable
to give some more attention to the ADL.
In sitting he could much but his trouser up and down was an great problem and always must someone go with him to the cabinet.
The perception of the affected side was very poor, the suggestion to exercise in water, he find that an very bad is idea. First he said that he was afraid of water but we think that he don't want to because he was not independent. Water immersion and moving in water gives more perception (Sato) stimuli

to the cortex than air and the reaction of the water by balance problems is bigger and brace the movement.

The treatment plan was:

1. Before and after each treatment to lose the joints and the tone.
2. Task specific resistance therapy especially in the back diagonal of the affected leg and the front diagonal of the affected arm.
3. Different walking style try to get more speed and more distance and an better condition with walking technique with hands-on facilitation according NDT –Bobath but also with other support systems.
4. Learning and exercise lying on his affected side.
5. Losing the nerve and teach him how to bend and hold his balance and get his trouser.
6. An better shoe for the feet on both side, the plantair flexion on the affected side was so much that there was an plan to elongation of the Achilles tendon but they risk of the operation was too high, therefore we decided to do this with casting and then make an shoe that hold the foot complete.
7. Special task specific resistance training of the not-affected foot and stair climbing.

3 times an week about 2 hours with an lot of rest moments .

Analyze of his walking pattern.

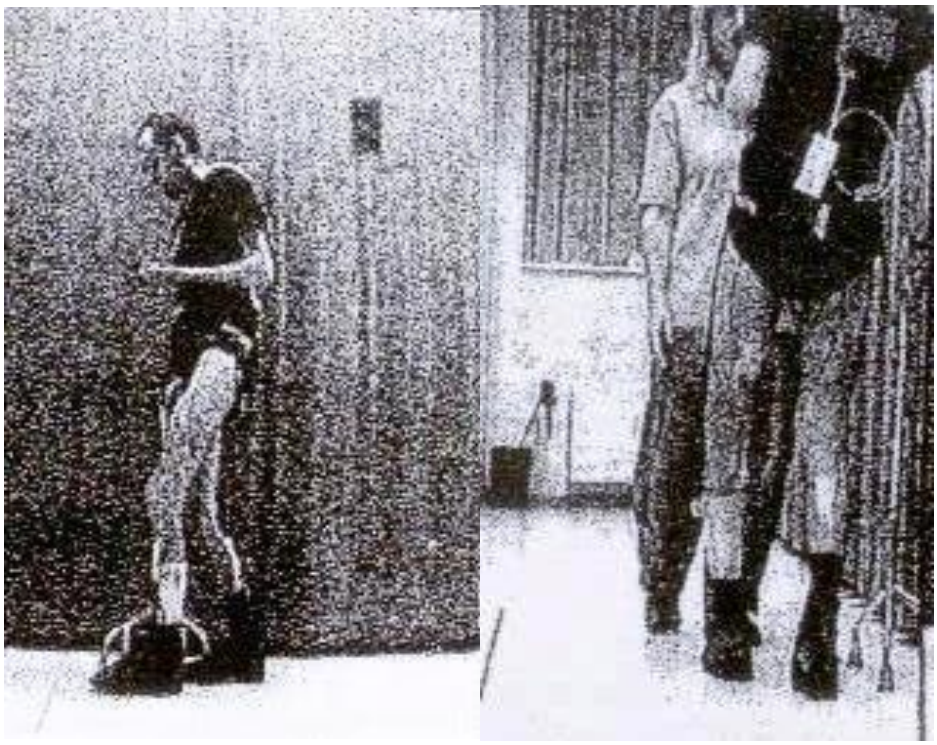


Photo 18 and 19.
The affected foot start with the “heelstrike”. But the loading process on the affected leg was never present, therefore the activation of the hip extensor was an little initiated but fall every time back to zero because the loading process wasn’t there.

He has had his head bend to see his foot and he is very focused. He want to bend his upper trunk even more, but the upper part of the back diagonal on the affected side makes that very difficult, the tone in the affected arm is extreme high. This because his weight bearing and control is done by his not-affected leg and that create an high tone in the back diagonal on the affected side

He has now more flexion in the lumbar spine, because he swing his affected leg with an tilt of the pelvis to the back and the upper trunk is on the not-affected side sideways and that makes it easy to lift his affected leg that stay in extension. (This is often the circumduction movement we see by individuals

after an stroke to get the affected leg to the front and is also an sign that there is no loading on the affceted leg/foot) The swing is very poor. Still the placement of the 4- leg cane is still further back The affected foot had still what inversion and nobody of the research institute dare to let him walk alone. And this picture were taken after 4 months of treatment and he could walk alone and dare that in his home and on the department.

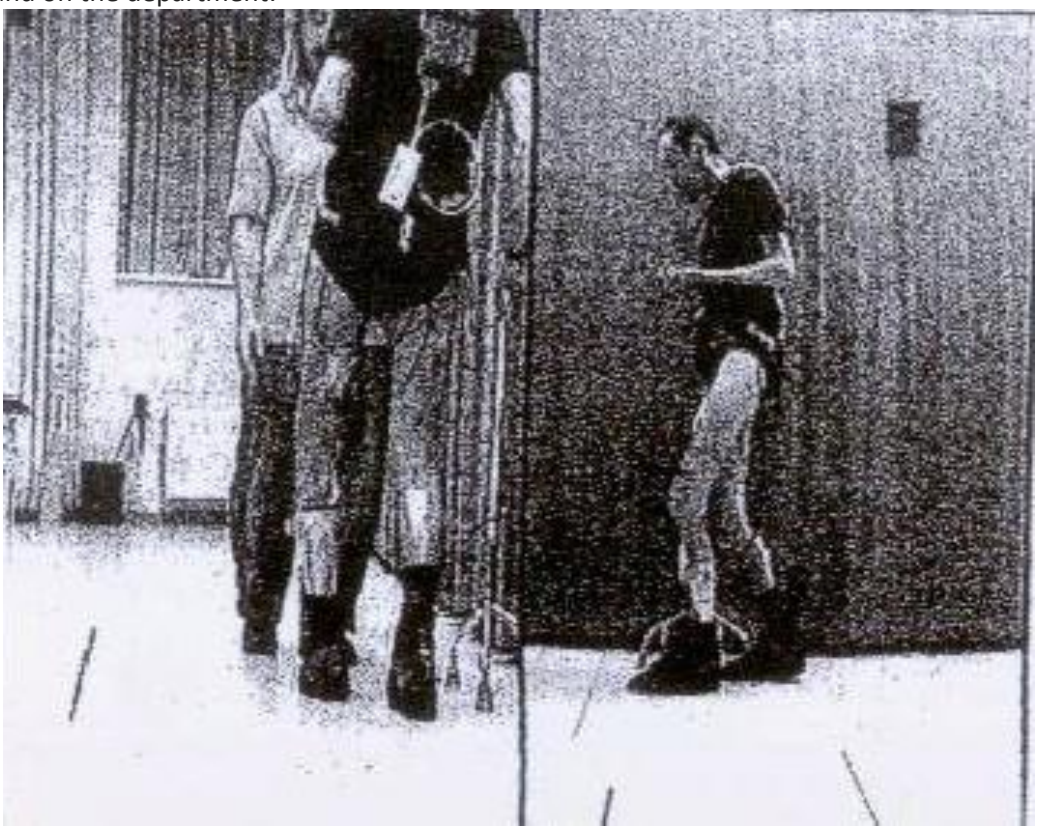


Photo 20 and 21
The loading phase and that loading phase were an critical phase. Still after 4 months exercise he was able to go through this phase but very slow. Four months ago he stand often still and go back to his not-affected leg and started the loading phase than again, sometimes three times for he make an step with his not –affected leg.

The only different with the end of the swing phase is that his body is more above his affected leg and the trunk has an little more extension. Further we see that heel of the not-affected leg has left the floor but still the most of the weight is on the not-affected foot and he push weight to his affected leg. Why so slow ? Because

He don't know or his affected leg has enough tone/strength to hold him!

He takes every time he stand on his affected leg an "risk" but he know that when he gives full load and push with his not-affected arm the reaction will come and will be enough !!

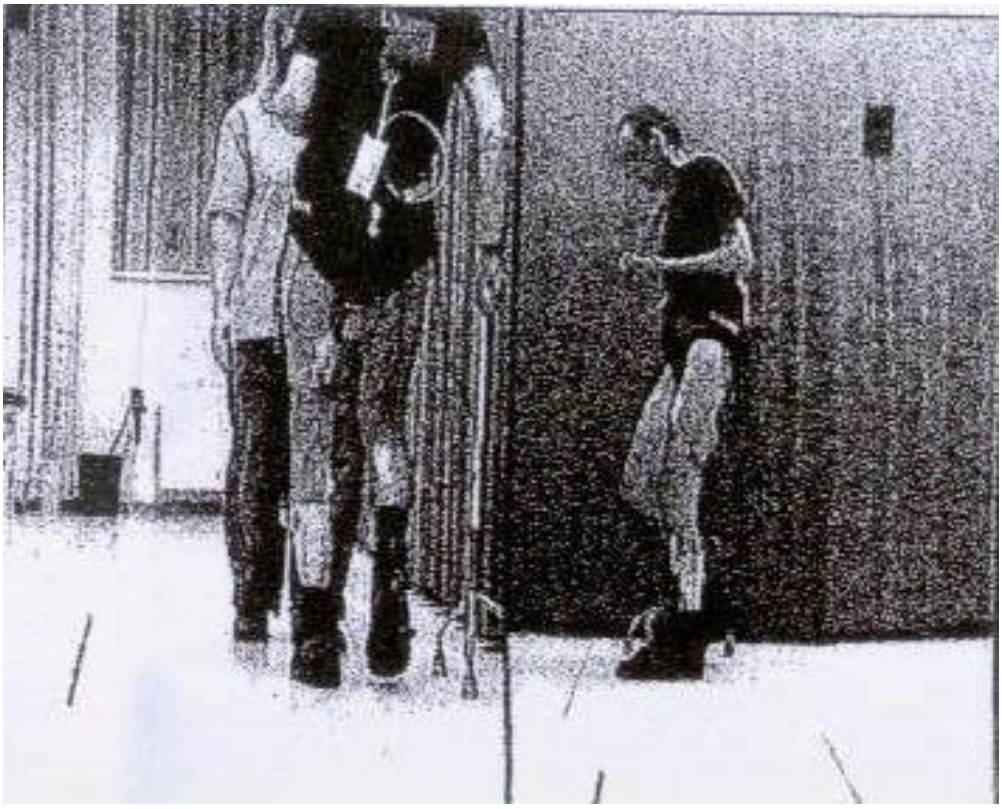


Photo 22 and 23.
The lift of the not-affected leg gives the tone that he need to stay on his affected leg and that tone he feel. Now he know that he can stand on the leg.

The attitude is still the same only the affected leg has now an extension function but when we draw an line from hip to the foot on the affected side than still falls that line behind the heel on the affected side. And that means that he falls back because he get his movement not enough over his hip. For 4 months ago he placed than his not-affected foot immediately on that spot and dare not the not-affected foot place further But photo 22 gives us the answer, that he is now capable to move over the hip and therefore he used the back diagonal started in the not-affected arm and that gives an action in the buttock muscle and makes an extension of the hip possible.

This push with the cane is essential to create an step that has more length through the activation of the hip extensor – diagonal !

Looking to all pictures the movement of the body stay almost always the same, the only different is the pelvis shift backward and sideway to get the affected leg to the front and the use of the cane to push and activated the diagonal from the not-affected always to the affected leg and the angle of the diagonal is perfect, there was than some activity in the hip extensor that make it possible for him to place his not-affected foot further to the front.

Furthermore this activation through the cane gave him an better feeling of the tone of his affected leg and that increased his walking speed. Less moment were necessary to “feel” or the affected leg can hold the load and that increase also his confidence.

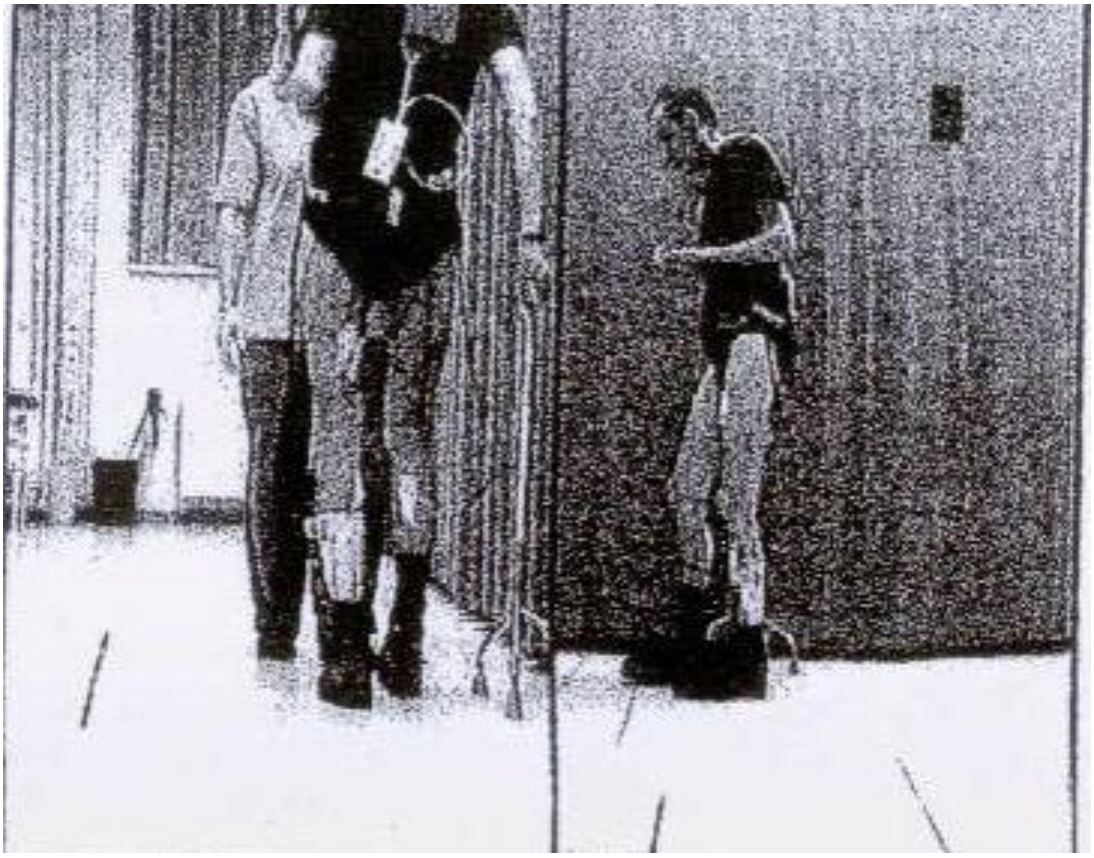


Photo 24 and 25
End of the stand phase on the affected leg

The attitude of the trunk is still the same but the not-affected foot passed the other foot by an half foot. Still very little but now further wasn't possible because of another problem. The movement in the ankle of the affected leg was on the end through the shoe and the construction of the EVO (Splint in the shoe) and we see that the hip on the affected side even turn an little bit to the back and on the not-affected side his hip makes an turn to the front to get the biggest step. Meaning that this is the maximal step he can make with this materialIn the future we must create more movement in the ankle through casting from his ankle with the calf muscles in an elongated position that will create more mobility. But the problem with the casting is that the shoe must be ready, when the cast is removed because we can elongation the muscle and create more sarcomeres in that muscle or make the cross –link lesser or inhibit the tone but we cannot stimulated the dorsal flexors to create more tone. In all photo's you can see that the shoes are identically, because booth feet need much of support only the affected leg need also support to decrease the plantair flexion with an huge inversion. The best he walk with the plaster around his ankle and that was speed and step length better but the problem is to create an shoe that give that effect and was easy for him to get him one.
The push to the back with his not-affected arm trough the cane is still going and he hold this push until the load and balance is on his not-affected leg. That means that the load on his not-affected shoulder is very great and that will ask for problemsTherefore he did strengthening exercise for his not-affected side in all direction to prevent complains. The 4 leg cane has so an dominant place in this walking pattern that is was very important that he learn other support tools to use to walk. Still with the push but with more variation that will make him less dependent of the 4 point cane but will also give an better coping of his not-affected shoulder. With the 4 leg cane the homolateral structure of the affected leg will not get better because the diagonal angle is more than 45° and that means that the adductor have an great part in the extension but still there was an concentric action in the m.gluteus maximus, that was activated through the push with his not-affected arm.

But the muscle were not complete only the medial part was active. Between the two part we can feel an piece with no action and the action from the lateral part was lesser.

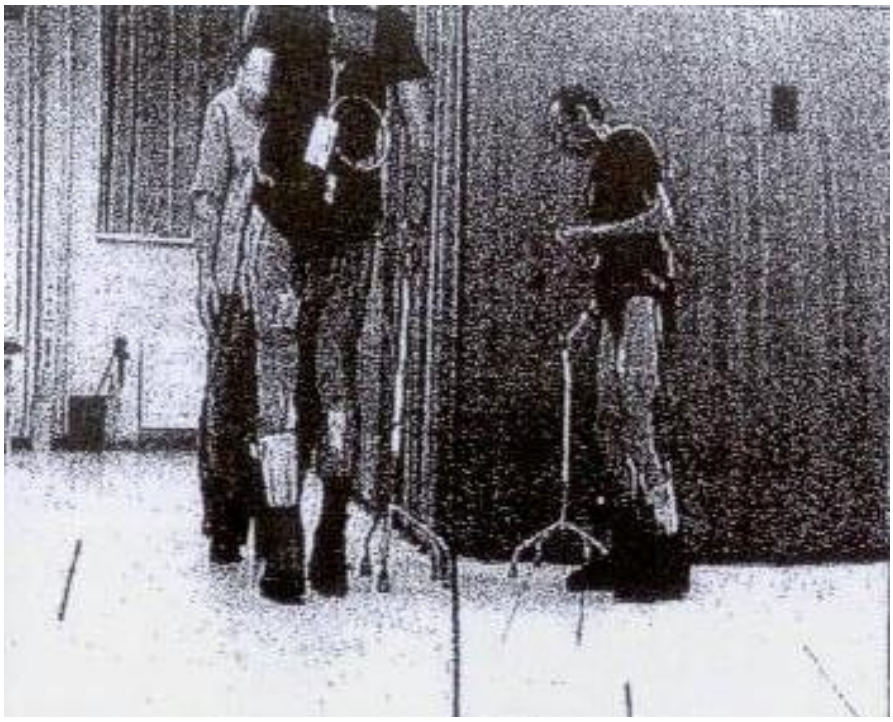


Photo 26 and 27. The balance is on the not-affected leg, the 4 leg cane is place in the front and the weight is from the affected leg. The swing phase can start.

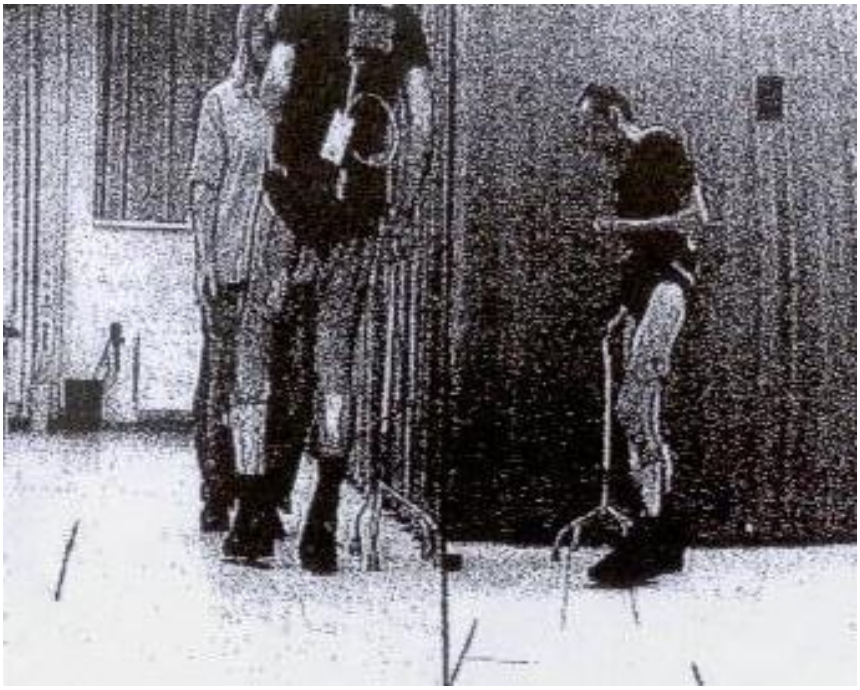


Photo 28 and 29 .Mid swing.
Circumduction means here; an upper trunk sideways to the not-affected side and an combined lift of the pelvis sideways and backward and the affected leg is free .Through the backward rotation he can give the affected leg an swing.

The attitude of the affected side stay the same and the position of the leg in the knee and ankle joint to. Only an light flexion increase of the lumbar spine is there when the leg goes to the front, together will the tilt of the pelvis he get the affected leg to the front. The tilt movement of the pelvis he makes with his not-affected side, that created more tension in the hip flexor on the affected side and make it possible to swing the leg to the front.
The leg stay in an extensor synergy.
Further one on no occasion we see clearly more tone in the affected arm(maybe the exception when he load is body weight on his affected leg) but the tone in the affected arm is very high and stay high.

That is an example of how <u>much effort the not-affected side</u> must do to get this walking pattern realized and how the diagonal starting in the not-affected side determinate the tone but also the synergy in the other part of the diagonal.
In the affected side this will be an extreme activity of the back diagonal leading to an retraction of the scapula and an flexor synergy/posture with high tone and that will lead to an problem with the mobility and the <u>possibilities of the affected arm. (A.D.L.)</u>

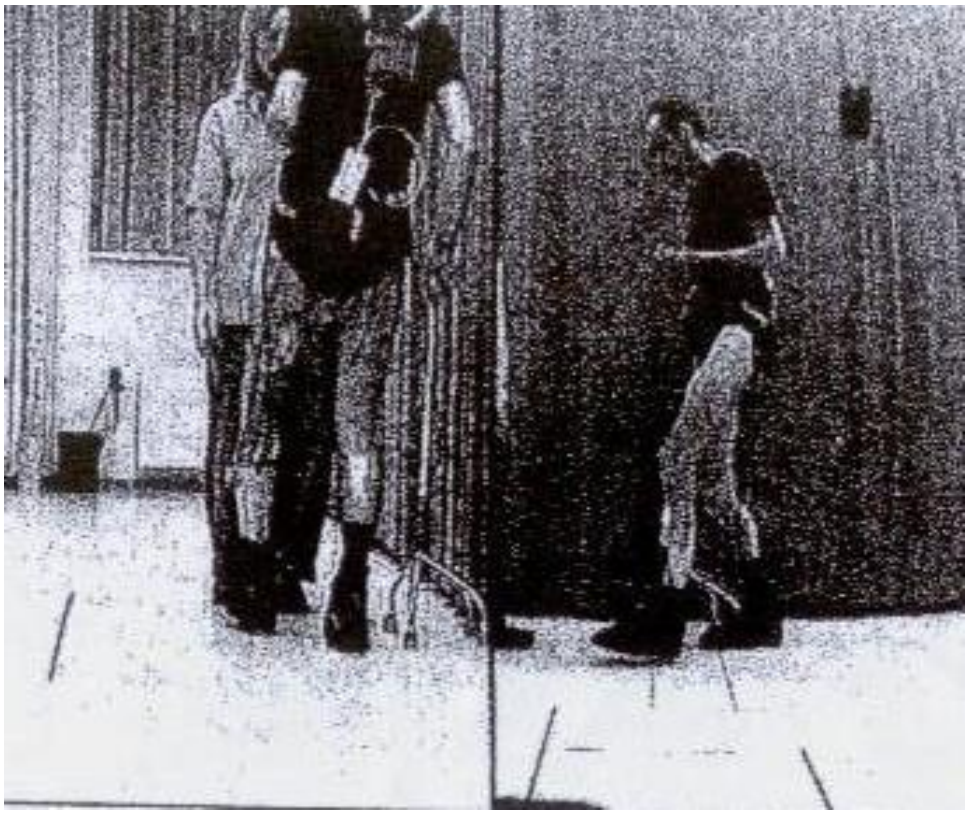


Photo 30 and 31.
End of the swing phase. The affected foot stand good for an heel strike but this will not activated the hip extensor because the loading activity is to slow, only the push of his not-affected arm together with the load will give an concentric action when possible.

Normally will the m. gluteus maximus be active on the moment of heelstrike. Because the muscle is than very long and has an lot of energy and the weight is on that leg , together will give this the action that pull the leg over the foot to the front.

He must activated this muscle on another way :

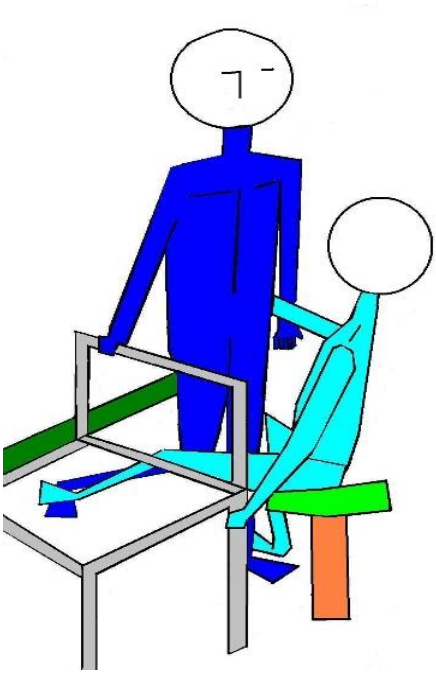
1. What he do first is to bend his trunk to the front because he makes than the m. gluteus maximus larger and then he lift his not-affected the stretch of the muscle is enough to get an contraction.
2. This is an reflex , the stretch goes as stimulus direct to the spinal cord in the senso part and comes on the motor system as an action. No brain his involved. This strategy will have consequents because the muscle will function lesser because the stretch and the lengthening will decrease the muscle capacity.
3. The loading is to slow to get an huge activity in the hip extensor and because the diagonal has an wrong angle , the most of the action will be done by the adductors on the backside of the hip.
4. The only activity that give an action in the whole diagonal is the push with his not-affected arm and that is also the reason why he placed his cane on that spot. The combination push and activated the back diagonal together with an better angle can created an situation that the activation as before can be used of course limited but that is the purpose of the treatment.

Treatment:

There are after 4 months little changes in his walking pattern, but still his walking is very poor. The greatest change was that he no longer bend his trunk so far to the front to create an stretch extension, but through the pushing with the 4 –leg he manage to activated an part of the back diagonal with an part of the m.gluteus maximus active.

How we achieve that ?

1. First part is task specific resistance therapy against the not- affected leg with an resistance, that was near maximal of 90% R.M. (Repetition Maximum) and then 3 times of 7 times still we feel muscle fatigue symptoms and that 3 times an week.



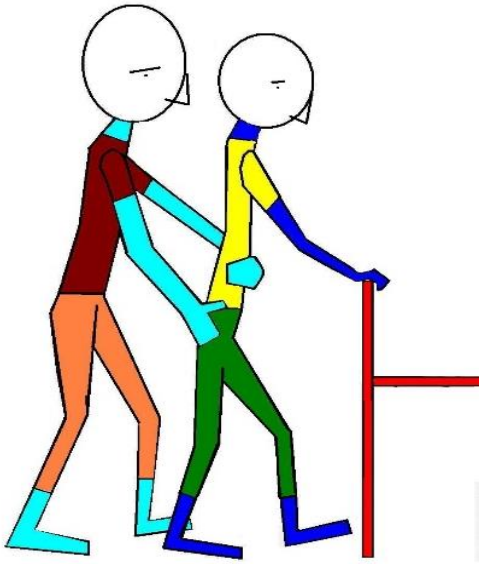
Picture 15.

Resistance against the not-affected leg to create an concentric contraction in the whole back and front diagonal from the not-affected side arm /upper trunk to the other side with the action of the trunk/ buttock.

By mister J.J was this so not possible. It was too unstable, therefore we placed him in front of an high bench so that he can supported on his elbow and we started with lifting of the not-affected leg and give resistance on this lift.

After 2 months he was capable to do it as on the picture. In the beginning was the swing of the not-affected leg very little but that increase every month. The resistance was high from the beginning because we want muscle power back and of course more coordination but muscle power was essential.

To change his walking pattern, he must learn to create the same situation that he create with the chair to push this with his not-affected arm down and back.
With 4 leg cane he was then not capable to do this, therefore we make the back diagonal of the not-affected side longer and create so more tone in the diagonal through an pushing activity with his not-affected arm. In this case pushing away an heavy chair and that with hand-on facilitation to stimulated the push of the arm together with the loading on the affected leg and create so an good angle in the diagonals.



Picture.16.
An facilitation technique of an famous NDT-Bobath senior Instructor Joan Mohr. The hand of the therapist are on the affected buttock and the other hand on the belly.
Standing on the affected leg he push with his not-affected arm/hand the chair to the front and create so more tension/ contraction in the extension of the hip. Placing the not-affected foot to the front and the heaviness of the chair together with the hand – on facilitation stimulated the diagonals in the right angle. Often in the beginning an volunteer must pull on the chair but very soon he was capable to push the chair on his one. Now was increasing of the speed possible but also load on the chair to create more muscle power and coordination.

Another variation is walking along an high bench and then pull with the not affected hand on the edge of the bench on the moment that the not-affected leg swings to the front. Now the back diagonal will be active and create more contraction in the diagonal.

Photo 33.
Pulling with the not affected arm.
This is not the correct moment.
Because the affected leg isn't standing in the right position.
The therapist is together with the person to create an swing to the front but the not affected hand stand perfect, supported on the elbow with the thumb around the edge to pull on the bench when the affected leg stand in the right position and activated the diagonal.
Again is there an hand on facilitation necessary because the balance is very poor, the swing not yet independent and this makes it possible to control and correct the angle of the diagonal to get the best activity in the buttock muscle.
This arm activity will then be exercises with straight elbow and often in the corridor through the railing.

Creating an diagonal that he can activated with his not-affected arm/trunk, and make it possible to walk with less cognition but also walking sideways and backwards. Stair walking was possible at last for 5 even 6 steps, always with placing the affected leg along the not-affected and on this way up and down.
Now we started to try to make greater steps but then there must be an hand-on facilitation necessary of the affected leg in the swing of the two steps up and down.
After 6 months we try to get turn and go down the stair normally, on an little stair this was possible but on the normal stair, he was so tired. Walking in the corridor and pull on the railing when he swing his not-affected leg to the front became one of his favourites, he had than so much support and not afraid to fall that he start doing this before he arrived on the exercise ward. And he makes than the greatest step through the problems that were there through his shoe and splint. Walking with an special rollator frame was, he could walk without facilitation with the chair and he was capable that also to do with the rollator frame.

Photo 34.
Walking with an rollator frame and….. listening and give answer.
He did cooperate with an course and would explain to the course member why the affected arm stand in that position and why he has now his pelvis tilt backwards thus making an flexion of the lumbar spine.
By making his arm long and push on the frame – down- , he could activated the back diagonal with the m. gluteus maximus.
Now he had no support on the side but in the front and that ask more of the homolateral pattern of the affected side.
This because the angle of the diagonals will be better trough the hip than with an support on the not-affected side.
Of course stay there an upper trunk sideway to elongated the affected side and make an step of the affected leg to the front possible. (Circumduction)
We (J.J. and the therapist) were very proud on this day !
Differential learning , repetition through variation !!

Next treatment goal was lying on the affected side and of course learning how to turn from the supine position to turning on the affected side.
We must start with him with all support there is, for an side lying position and also in the middle of the bench. The support that he need too dare to lying and decrease the tone was equal with the support, that we realize by individual with an severe stroke at the beginning of the rehabilitation.

Picture 17
Lying with an optimal support on the affected side. The green (hard) pillow under his affected foot was from great importance. He don't feel much in that foot but the restriction in the extension then he feel safe !
This was be done with no shoes or splint to see what the reaction was of the tone in the affected side.

1228

From this position we started to work on movement first and then especially movement of the not-affected leg. Later on we make the number and quality of the support pillow lesser. Movement training: first the not- affected leg from the green pillow up and putting down behind the affected leg. After that the whole program till he was capable to turn back to an supine position and turning back on his affected side and coming to an sitting position on the edge of the bench. He was capable to exercises this also at his home and in his own bed.
But do this turning with taking with him the blankets was very difficult.
Now he can use in this position the homolateral structure more and we have now after 6 months of treatment the point achieved that resistance is possible and hope that the muscle and coordination will grow and be translate in his walking pattern.
But there was in this position and other achievement:
When he lay on his affected side and he lift his not-affected leg and move an little bit to the front there was an **extension reaction** in his elbow.

Photo 35.
On this photo we see the automatically reaction of the elbow to extension to brake the movement of the trunk to the front .
This is an support reaction that only occur when it is needed and show that support reaction lay not high in the brain.
This we say happen in J.J arm and was the first time there was an dissociation in his flexion synergy. Because extension in the elbow is part of the extension synergy.

He was after 6 month capable without lifting the not-affected leg to stretch his elbow over about 30° degree and was capable that also to do in sitting position against resistance but in standing and walking the tone remain high.

<u>More independent !</u>
He was capable now to do everything in sitting position even his trouser and socks/shoe's because he was now capable to bend his trunk in sit and touch the ground. That wasn't possible in the past through the restriction of the nerves tissue. Thus in this case was not the balance in sitting position his greatest problem but the mobility of the nerve tissue.

There were in the assessment signs that gave that direction because he was capable to sit with the legs crossed.

The ADL training done by the occupational therapist was very successful but still one problem exist ! The moment, that he must go to stand and stay stable and bend to catch his trouser was still not possible. We went to his home to see, which possibilities there were and see an huge bathroom where two wheelchair can passed each other and there were everywhere support possibilities but when he must stand with his not-affected hand and was dependent of someone else. We look in his home to other solutions and he had still his old toilet with very little place and we decided to use this room to train another standing and bending performance. We create an similar room and start to train in this in standing en bending and taken the trouser.

First we search an wall with an support on the not-affected side, Than in standing position to lean against this wall with his not-affected shoulder and then with his not-affected hip.

Than to release the not-affected hand from the support and go with the not-affected arm /hand down After 3 weeks he touch the floor, but he must bend his both knee because the tension of the nerve tissue was lesser but with an stretch knee the tension was so high that he couldn't touch the floor. When mister J.J was capable to do this movement and there was an safe feeling, repetition was no problem. After an while he was capable to bend, take his trouser and put him on and finished the dressing sitting on the toilet pot. The situation of his toilet and where we put the supports.

Photo 36.
His toilet at home.
Small and therefore perfect to lean against the wall. There is room to lean with the hip against the wall and bend to the front even with the door closed.
But were the supports on what side and how high and which one ?
Look to the black and red stripes !

The not - affected arm/hand is right, he enter the toilet and had an support one stay high right , he now must turn and had an support left (for him right) that is lower. The top is for staying but the rest is for sitting down and standing up. We realized that he will pull but he will pull with an "good" vorlage and there is room too lean against the wall and bend to get the trouser.

In the large bathroom there wasn't an support to make the "vorlage" and no support to lean with his not-affected side against the wall and free his not-affected arm/hand to get the trouser. That bathroom was created for the care giver and not for the person after an stroke !

The best kind of support for him was :

Photo 37 .
The angle in which this support stay is good but we use an large one than there was more possibilities to varied with the position.
This is the black one (photo 36).
Still he pull elsewhere on an basin because that is easier. This askes less upper trunk backward and therefore less exorotation in the glenohumeral joint.

1230

Better ankle position

The plantair extension together with the inversion makes his ankle vulnerable. We had ones give him an treatment with casting technique that increase the dorsal flexion of the ankle by creating more sarcomeres in his calf muscle. The tone of the calf muscle as an part of the extensor synergy and the absent of the antagonist makes it necessary to do it after 3 months again. We want to created and stabile foot with regrettable only one point of recognition (perception) but still the right one . Why we know that ?

Because he walks far much better with the casting than with which shoe than- ever! Plaster gave him must more support than the shoes or splint can do and that is very important information but we must also calculated that he must be capable to put on this shoe and that is always the problem. Therefore we cast after three months and make new shoe with an new splint and say an lesser walking performance as in cast but better than first .

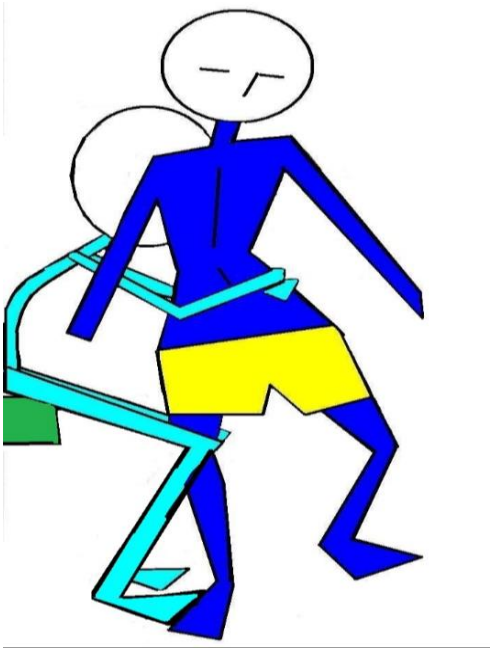
How to cast and inhibited the tone will be discussed in the article “contractures “.

Task specific resistance training of the not-affected foot and stair climbing.

The not-affected ankle had suffered, we assumed, from an early hernia problem and therefore wasn’t capable to give the cooperation that we expected of an not-affected side. Therefore we make room in our treatment program from task specific resistance treatment for this ankle to get muscle and coordination improvement.

How we can find an R.M of 100% for this ankle ?

And how we create an task specific resistance exercise, there we must find an safe way of standing on his leg and then we make it difficult that he must work on the right level of the R.M.



Picture 18
The “Berengriff” in German.
He stand on his not -affected foot and the therapist sit on the edge of the bench, fixated the knee and take the lower trunk and bring the on the right spot that al the weight is on the not-affected leg. When it possible the patient may lift his affected leg but our Mister J.J. cannot do this .

Now we want to know what his R.M. is for the plantair flexors, the dorsal flexors and the evertor of the ankle

R.M. (Repetive (Repetition) Maximum

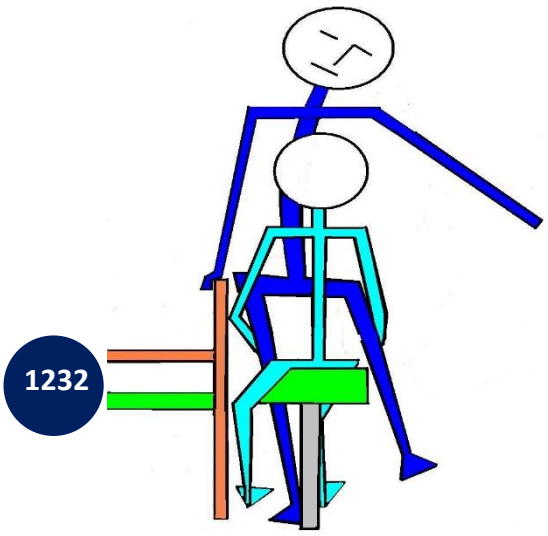
Plantair flexor; try to get the heel of the floor, he can do that but when the therapist shift his weight an little bit to the back he was not capable to lift his heel. We know what 100% is and can exercise the plantair flexor against resistance and increased the power and the coordination

– Dorsal flexor, now the therapist placed an foot on the foot of the individual or placed that foot under the last sport of wall rack and lift the body an little bit to the back .He must now give maximum dorsal flexion and flexion in the hip to hold that position and we know what 100% is.

Evertor , in figure 18 the therapist has placed his foot against the lateral wall of the foot he now pull the patient closer to him and ask not to touch him thus he must work to the affected side.

The moment that the medial part of the foot is coming off the floor the therapist search for an method to increase the load by shifting the weight on the not-affected foot and there is an moment that the patient cannot lift the medial part anymore and that is 100% or 1 R.M. standing on his not- affected side he train now the action that he must make for the balance reaction especially the brace reaction, therefore keep in mind also which movement the trunk must make.

This is an training exercise, he must also learn to stand on that not-affected leg because he can then use the increasing power and coordination.



Picture 19.
Feel how far he can go when the balance is almost losing , lateral , to the front and back. Start with an chair the perception of many stroke patient is change and they are often not capable to go far enough to the lateral and then the feeling under the foot isn't stimulated.
Start with the good arm on the chair but give load on the not-affected leg . If necessary, you lift the affected leg and let him feel.
And hold movement than will he get information to his brain.

Stair climbing.
Was an great problem but he started after three months treatment and had now more confidence . And the first time we only go with facilitation up and with the elevator back, after an few weeks we go with facilitation on the normal way up and down .
Before and after each treatment we lose the joint and the tone. This was always the start of the treatment but also the end of the treatment. And it was of course an ungrateful job because always on the start and on the end of the treatment the tone was high and you know that everything was gone after 5 minutes of walk but you feel also that the resistance was not so high anymore and that was not because the tone decreased but because the not-elastic tissue were smoother. And when there was action of muscle especially the antagonist than you feel that the range of movement increase.

Klinimetric after 6 months (A = start of the treatment. B = after 6 months)
A =10 meter walk test = 40 sec. and only 1 time than rest and he did the second run and then rest and the third.
B = 10 meter walk test with 4 leg cane 30 sec. and no rest between the runs. But with the special frame rollator he was much faster and did it in 20 sec. 3 runs . With the Nordic walking stick 30 sec in 3 runs and he was capable to walk with no cane but with somebody but only 5 meter and then was the pocket empty.

A = Berg Balance Test = 27 /58
B = 34/58 and 38/58, why two because when he did it on the difficult way he score less than he choice the easy way, on the easy way his improvement was significant but not for both side. Still the danger of falling was great.

A = Trunk Control Test= 75/100 turning to the affected side was not possible
B = T.C.T. = 100/100

A = Motricity Index(M.I.) for the arm = 9 and leg= 18
B = M.I. arm 14 (elbow) leg 18

A = one leg standing not - affected side less than 10 sec. and affected leg not possible
B = 20 sec and on occasion 30 sec. Our world record was 5-10 sec on the affected side

No progress possible after 6 months ?
Certainly but release that many of this progress was obtain by increasing his powers on the not-affected side. That and the exercises increased his confidence and his condition. The possibilities of the affected side - leg and arm - are not increased very much but more power in his diagonal through the not-affected side gave more power and coordination in the trunk and has influence on the keypoint especially the hip on the affected side.
That is very difficult to be measured but makes that the affected side give that little more and that makes the difference.

What will happen when he stops with this treatment program, as the load/resistance is gone and no task- specific resistance treatment will be done anymore and the brain is not push to the limit?
Mostly you don't now, but in this case we know.
Regrettably he stop with the treatment after 8 months because he move to another place and go to live on his one. But he had no money to travel to our department therefore he choose another therapist.
We phone and write what we had done and the therapist ensured that he will do the same.
But that wasn't true, the therapist started with an "evidence based" treatment for chronic stroke patient and concentrated the exercise on an kind of circuit training system.
There is in the guidelines of the stroke rehabilitation significant prove that this is the best way to treat chronic stroke patients but that means you exercise only what you can, not what not can of not without assistance.
The so-call hands-off strategy and that he need to get walk without an support, to increase speed, to climb stairs and to increase the power and the coordination of the not-affected side and the affected side.
After 4 months the therapist send the klinimetric and ask why he couldn't hold his level ?

Klinimetric after 6 months (B = after 6 months C = After 10 months)
A =10 meter walk test = 40 sec. and only 1 time than rest and he did de second run and then rest and the thirth
B = 10 meter walk test with 4 leg cane 30 sec. and no rest between the runs. But with the special frame rollator he was much faster and did it in 20 sec. 3 runs . With the Nordic walking stick 30 sec in 3 runs and he was capable to walk with no cane but with somebody but only 5 meter and then was the pocket empty.
C = with an 4 leg can the speed was 30 sec. without rest. Special frame rollator was not possible but we test and that was 30 sec, Nordic walking wasn't possible, because he had never do this anymore and without support not possible. Only the walking with 4 leg cane was part of the therapy.

A = Berg Balance Test = 27 /58
B = 34/58 and 38/58 , why two because when he did it on the difficult way he score less than he choice the easy way , on the easy way his improvement was significant but not for both side. Still the danger of falling was great.
C = 30/58 and he may do it on the easy way, because the other way he was to afraid. (walk an stair up and down, he had only exercise an stair with 3 steps, the stair in our department 2 times 14 steps, he was to afraid he dare not to do this.

A = Trunk Control Test= 75/100 turning to the affected side was not possible
B= T.C.T. = 100/100
C = T.C.T. still 100/100 but lying on the affected side was more difficult and he dare not so much move with his not-affected leg to the front and back

A = Motricity Index(M.I.) for the arm = 9 and leg= 18
B = M.I. arm 14 (elbow) leg 18
C = M.I. arm = 9 extension of the arm was gone and leg= 18

A = one leg standing not affected less than 10 sec. and affected leg not possible
B = 20 sec and on one occasion 30 sec. our world record and 5-10 sec on the affected side.
C = less than 10 sec and with the wrong attitude, not lower trunk sideways but an upper trunk sideways and the affected side not possible.
But the ADL he had still complete under his control but the result give us the certainly that exercise need more than only repetition but repetition with variation and create for the brain problems to solved.

His therapist was an man with the hart on the right place, we met and go through the whole treatment including the inhibition of the tone and the treatment of the joint and nerves , because there was change very much to the worse but reversible and the last contact we had , he wrote on email : “I have walk 5 meter with no support on my one !”
This progress , how little it is, is the best guarantee that the quality of live is increasing for him!

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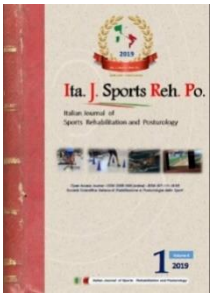

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