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Research Article

Backward Falling Elderly

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Abstract

Introduction

The investigation with video recordings through Prof. Robinovitch and colleague gave as outcome that backward falling was the most common fall accident in long car facilities.

Walking with an walking aid as an rollator frame gave no solution, elderly in long car facilities felt with this device also when the walk backward and often within three or four steps was the fall in progress.

Almost always was this an situation that was unstoppable and needed often the first assistance and/or supervision but forward walking was still good possible.

This great difference make us curious why walking backward was so risk full for falling.

Methods

An assessment was done by all people that has problems with backward walking but still walk good forward.

This population was very diverse. There were people out the long car facilities, nursing home residents but also elderly that live in their own house and about eighty precent has an diagnosis dementia.

The assessment contains investigation of the perception, the motoric reaction, balance reactions, tone and the selectivity.

Further one we search in the literature for investigation on this subject but also look at video captures how this fall take place and make an analyse.

Conclusion

The two elements that has the most impact were :

The stiffness of the trunk hip through pathological tone and/or hypertonus to maintain the attitude.

The perception under the feet with an direct relation with weight bearing but also the reaction of the balance system that was often not on right moment.

Kew Words: backward falling; balance; perception; pathological tone

Introduction

In 2017 published by K. van Schooten and their colleagues [1] an article that was an continuation of the famous article in the Lancet from Prof. DS. Robinovitch [2] and his group of investigators out 2012. That article was very important because now we could invest what the reason was that elderly fall and could this investigator group start with further assessment why this group of people fall.

Especially the group elderly with and without dementia and living in Nursing homes and/or long carfacilities. Till than there were articles that try to assess [3] this problem but often they were limited, because they saw this people not fall.

That was an problem, because the method that was used, was asked this group elderly : "Why are you fallen ?" is often misunderstood and often was the person not capable to give an good answer. The answer is for everyone difficult, because often is an fall an nasty experience and is the reason for the person not clear and then will the answer often an guess.

This period has consequences because the idea was then that there was an correlation directly with the disease especially dementia.

That there is an direct correlation exist between fall and neurological disease is obvious and that is also the case by people with dementia.

But often where the focus placed on the behavior component [4] and again that can be an reason, when people are afraid, wound up of in panic but again than is every elderly dangerous and not only elderly.

Than was the assumption that the cognitive element was greatest reason, that this group wasn't capable to copy cognitive with the environment and that

makes this group dangerous for falling. That older people with dementia frequenter almost two times, so often, but the problem isn't notthe cognitive aspect but the whole brain has an slower information processing.[5]
This slower information processing and the investigation of the Robinovitch group is clear thegreatest reason why elderly with dementia fall often.

And special backward fallen is the greatest group. Out the investigation of K. van Schooten and others came the following data.
Direction of the fall in Nursing Home [1] and what was the activity at the time of the fall.

Backward direction	**33.8 %**
Sideway	**28.8 %**
Straight down	**19.2 %**
Forward direction	**18.2 %**

Table 1: Activity at the time of the fall.

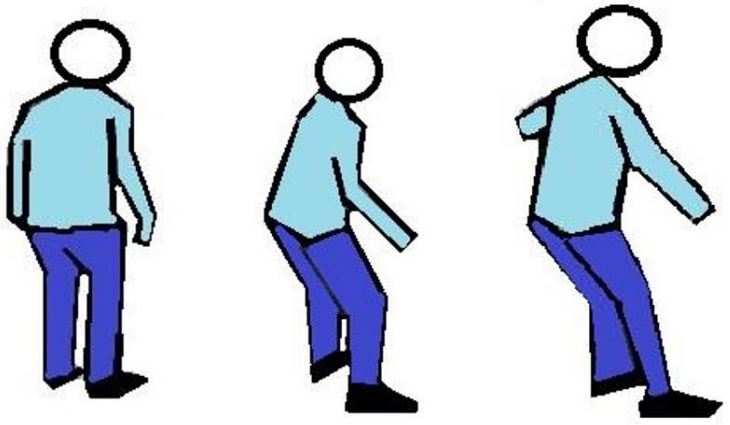
Walking	33.6 %
Standing	24.0 %
Stand to sit transfer	17.5 %
Sitting	14.2 %
Sit to stand transfer	10.7 %

Table 2

Incorrect weight transfer	49.5 %
Loss of support	22.0 %
Trip of stumble	12.5 %
Hit of bump	8.8 %

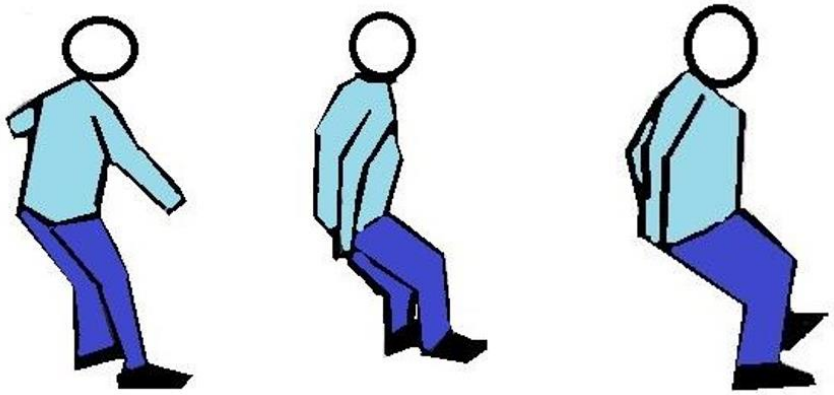
Table 3: is an continuation [1]. Common cause for fall in Nursing Home.

Back ward falling in pictures.



Picture 1 **Picture 2** **Picture 3**

Picture 1, 2 and 3.
Picture 1 is the position that she had when she started to walk to the back. Back falling will give an reaction that has two important elements by elderly. This two started on the same time and moment and take care for preventing the fall through an step strategy.
This two elements are :
Dorsal flexion of both feet and
An trunk/ hip flexion with an anteflexion of the both shoulders at approximate 90 degrees. Picture 2 show no great dorsal flexion in the feet and in the hip and trunk is also little flexion but in the knee is some flexion but normal is this not the case.
In picture two occur an arm flexion but when we look at picture three this almost the same. Again there is no dorsal flexion visible and the trunk/hip flexion stay at the same level as in picture two.
Comparing this with an normal reaction than is the position clear that this fall isn't to avoid, because there is so many weight behind the heels and there still no action to place an feet to the back and stop the fall movement.
But the question her must be, why this person react on such way and why this person isn't
capable to stop this fall movement.
Therefore she need and brace of the fall movement and in that brace there must be an clear shift of their weight to one foot and make so the other foot free and place that foot far behind.
And looking at this three picture there is an attempt to brace the fall movement but no shift to one leg occur.
Picture 1,2 and 3 published with the responsibility and permission of the author by j.v.d.Rakt.



Picture 4 **Picture 5** **Picture 6**

Picture 4,5 and 6.
In picture 4 there is still weight on two feet and the trunk and arm movement are the same.
In picture 5 we see the right foot react and the arm goes to the back. This looks as an sign that the brain of this person has understand that she is making an falling movement. Dorsal flexion to try to brace but the arm reaction is an reaction to try to catch the fall movement with the arm. Strange; an first balance reaction to create time for an weight shift and on the same time an response to catch the fall with the arm(s).
Still in picture 5 the feet stand both on the same place without weight shift.
In picture 6. We see now that left leg is free but goes to the front and the other foot stand still on the same spot.
The trunk/hip movement is on all three picture not changed only the knee flexion is increase in the right leg.
Picture 4,5 and 6 published with the responsibility and permission of the author by j.v.d.Rakt.

Normal balance reaction to the back.

Normal balance reaction for elderly is different that the balance reaction of younger people. Young people will, when they back walking often need only an simple reaction with the feet but elderly will need the feet and the trunk/hip reaction to brace the fall movement to the back.
Why this difference ? And is that still normal motoric ?
Become older is an process of adaptation. That means that elderly persons are busy continue with this adaptation and that will an body that is decreasing in all the functions that make balance optimal.
As the elderly let go things that he did before with his eyes closed than is that the sign that he knows that the risks that he can take are lesser.

Balance reaction is an reaction in which speed is an important issue and the amount of speed is decrease on all fronts and when we look how elderly move than is it clear that adaptation is going one.
It is important that therapist understand that balance problems is sign that the adaptation isn't enough anymore and that the fall was there an important sign that the system has not the whole control.
To find the missing link why the fall risk is on that moment is greater than an period before is important and asked for an good assessment. Because the reason can be so divers and isn't treatable with an simple training of balance and certainly people neurological disease as dementia.

Backward falling asked that elderly react with the feet and trunk/hip in his total.

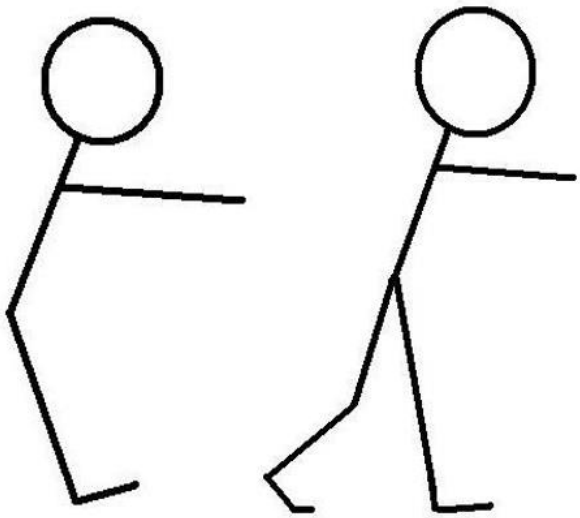


Figure 9 **Figure 10**

Figure 9 and 10.
The balance reaction that elderly need to prevent an fall incident. That is by an firm balance disturbances, all systems from feet to trunk /hip and all together and on the same moment.
The movement in the trunk and hips toward flexion is essential to create together with the dorsal flexion an delay of the fall movement.
That delay we need to shift the weight totally to one leg and make the other leg complete free. An good balance reaction is the guarantee that there is enough time to make an weight shift. Picture 9 and 10 published with the responsibility and permission of the author by j.v.d.Rakt.

Balance reactions create time in which the shift of weight take place.

That shift must be complete because otherwise is the other leg not free and arises there the first problem to make an good step-strategy.
That free leg - step-strategy - must go far to the back.
The movement of the trunk/hip determinate the movement of the free leg. And this will be more extreme when the selectivity is lower.

Trunk/ hip- movements determinate the movements of the free leg !!

- Trunk/hip to the front, the free leg goes back.
- Trunk/hip to the back, the free leg goes to the front.
- Trunk/hip in elongation position, the free leg can cross
- Trunk/hip in shortening position, the free leg goes in abduction.

The power must be delivered through the pattern on the front side. That aren't the strongest group but the have the capacity to react fast with an flexion in the hips/trunk and with an dorsal flexion in the feet

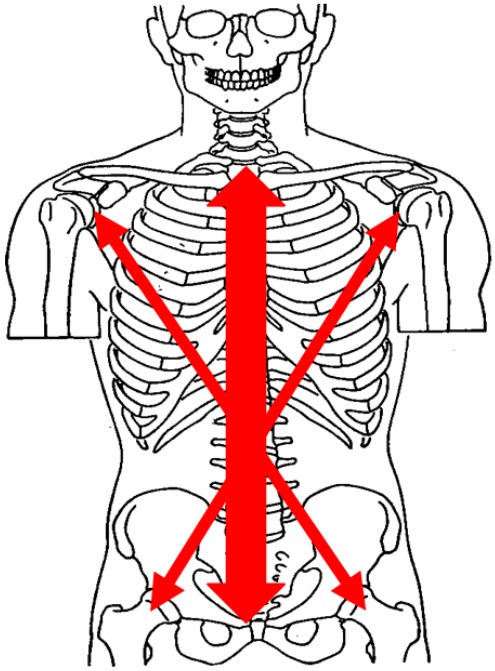


Figure 1.
The muscle pattern are situated in an cross form, started in the hip through the m.rectus abdominalis always to the shoulder on the other side. Of course is the action an complete flexion of the trunk/hips to get an great part of the body weight to the front and brace the fall movement to the back. [6]
Together with an firm dorsal flexion is this the strategy to create an bracing movement to get time for the weight shift that is necessary to get an free leg for an step-strategy.
Dorsal flexion muscles [7] are weaken by elderly as also often the muscles on the front. Still is that amount enough to react probable on an disturbances.
But when this is to low than will dominated the back muscles an this can give an fixation of the trunk.
Figure 1 published with the responsibility and permission of the author by j.v.d.Rakt.

Loss of muscle power can therefore an reason that people cannot react on an disturbance in the front but still is it strange that only this would be the reason. Because an disturbance from the front is visible and by walking to the back would an relaxation of the trunk be possible.
of course an great loss of power would lead to an dominancy of the back but that is the question on his place that so many loss would inhibit all movements. Also standing up and walking.
Still this could be possible but in our belief not the most common reason. As cause we think on :

1. Loss of selectivity through loss of perception and therefore an less good input system. Awareness of movement under the foot and where the centrum of gravity exactly is.
2. Loss of selectivity through an pathological tone. By people with dementia is that paratonia. [7,8]
3. Last part is that body perception to move sideways is changed and that this inhibit that the weight comes total on one leg

Ad.1. Loss of selectivity through loss of perception and therefore an less good input system. Awareness of movement under the foot and where the centrum of gravity exactly is.

Elderly with dementia have an perception system that often must participated with an worser input system. Till now it is this not certain what the reason is for this loss of input.

There are two possibilities and of course is there an third option that both elements are the cause :
1. Paratonia is an neurological form of tone increase as an answer of the damage brain in the cortical part. That makes that selectivity must be changed in more tone and the possibility to restrict the freedom[10] possibilities of the joint movements. But this tone increase, has an influence on the possibilities of the muscle spindles and that makes that this information is different and often far less selective. Thus tone-increase is an sign that the selectivity is lower and that the input is changed and less refined.
2. The other possibility is that the input system is of an lower quality. All senses are lesser and especially the movement feeling (discrimination-sense[10]) and recognition of the quality of the support (gnostic sense[11]) are less by all elderly. But there is an rare element that especially elderly with dementia that are dependent in their movements, learned of this assistance and that changed the perception of the body. And that cognitive impairment has an influence on the body perception in the lying position in bed [12]. This will also occur in sit and standing position but there is no investigation on that area. Still there are signals that people that have assistance by the transfers that this changed their body perception in standing position. With support behind gave this people an signal that standing oblique to the back was in their perception right and the position right in our eye gave the feeling that they are falling to the front. The consequences of this changing of the body perception is that the balance reaction to the back get the signal in the brain later, even behind the heel and that will have an devastating result because everyone start to late.

Ad.2. Loss of selectivity through an pathological tone. By people with dementia is that paratonia.

This pathological tone is the answer of the damaged brain to control the movement through the synergies. But this synergies are movement pattern with an restricted amount of freedom degrees and that this means that selectivity is restricted.
The most important synergy for the balance is standing performance therefore the extension synergy.
That means that in the hip the tone of extension, endorotation and adduction is dominant. In the knee is that the extension.
And in the foot/ankle plantar flexion with inversion.
The muscle that take care for this synergy are the muscle that has the lowest selectivity and can work on the joint.
The adduction and endorotation of the hip will have an great impact but is necessary because this muscle can act for the hip and knee as an extensor and that is important because the selective extensor of hip and knee are not an part of the synergy pattern.
The feet are through this synergy vulnerable and asked for stability through shoes.
But the muscles that can place the hip in several positions, are through the dominancy of the muscles in the synergy inhibit.[17] Of course dependent of the loss of brain areas cortical.
The muscle that capable are for the great diversity, losses that power through the reciprocal inhibition of the dominancy of the muscle synergy pattern.

That means that walking with an straight spine and/or with an normal hip- and knee extension, because the synergy muscle pattern pull the leg in an adduction /endorotation with flexion in the hip and that count also for the knee.
This process is starting when the paratonia occur and will inhibit the speed that is necessary for an goof balance reaction.
One of the symptoms are that this person has difficult to walk straight because the hip extensor isn't
so active anymore and this extension is done through the adductor muscle group.
When we see that knees are going to each other is that an sign that the synergy is dominant but in the time therefore is this paratonia present and asked much from that person.
The presence of paratonia and the synergy has for that person indirect the consequence that the trunk is often in an flexion position but with an great stiffness though the paratonia but also as an reaction on the synergy formation in the legs and that explains the immobility of the trunk that we say by people that walk backward as in the pictures 1-6.

Ad.3. Last part is that body perception to move sideways is changed and that this inhibit that the weight comes total on one leg.

Photo 1

Photo 2

Photo 1 and 2.[17]
Photo 1 give with red circle the movement and the area under the feet, that young people use when the stand. Th sway of them is under the feet greater but therefore smaller in the remaining part of the body and especially on hip height.
Photo 2 give the movement with the red circle what elderly use when the stand on two feet. And that is compared with young people, smaller and restricted to the medial part of the foot. In the hip and trunk is there often more sway movement but when that is an upper trunk and that are also the reason that elderly change their body perception.
That is mainly sideway on foot height but also on hip height and that is one of the component that weight bearing is often not complete and that an part of the weight still rest on the foot that must make an step strategy.
This is also an part of the problem when people fall back ward.
Photo 1 and 2 published with the responsibility and permission of the author by j.v.d.Rakt.

Summary

Why is backward falling the most common fall by elderly and special elderly that live in long care facility or nursing home?

1.An great part of this people suffer from neurological diseases and that means that often the tone is pathological increase and makes balance difficult, but that higher tone is not alone present in the limb but also in the trunk and neck. The relaxation of the trunk muscles is almost impossible and replace this with an flexion in the hip is also difficult because here act the adductors as extensors.
2.But without an high pathological tone, elderly will often must have an higher normal tone in the spine to hold the trunk as erect as possible and that asked extra time to release that tone.
3.The perception is often changed through the caution and also walking with an aid as the rollator frame. The movement of the hip over the foot and under foot an restricted movement to the lateral. But by backward falling [18]is an extra perception deficit discovered but this is still an hypothetical why this occur. Elderly that walk backward and fall, let us every time the same process seen. Often three or four steps to the back, we see that the trunk is over the border of the back side of the heel. The strangest element is that this person give no balance reactions, not in the feet and not in the trunk. That whole balance reaction start much too late to give an proper step strategy, with as extra problem the stiffness of the trunk. The hypothetical part is why this balance reaction start to late.

Treatment or better slowing down this process!

1.Important is that the process of losing the perception of the body.
That means that there must be assessment what the possibilities are at that moment. That include the distal information senses as also the whole body perception through the use of the statiek technique. [19,20,21,23]. In the treatment-plan must that have an place from the day that especially standing up is difficult. Standing up by elderly is often done with using of the power of the arms. But when this power is required asked this for an upper trunk backward [6] and that will start the tonus increase in the back diagonals and makes this part of the trunk often more stiff. When this is the only way people can coming to stand and often accompanied with an assistance that stimulated this movement, will this further create only more stiffness and tonus increase in the upper trunk backward.
The lack of variation is one of the reason that the body perception changed and through the problem of the standing is the upper trunk always behind the feet and see we in the first period that the brain recognized that the balance isn't good. After an period this signal is gone and that signal- dorsal flexion- is than active when the this people are falling and then there is not enough time to react.

Photo 3 **Photo 4**

Photo 3 and 4.
Movements that are always the same have an influence on the brain. The brain that search for an solution when the power in the legs is insufficient to get in standing position. That is mostly the use of the arms to push and so relieve the legs.
But what is happen when the arms are dominant with the brain perception,
Photo 3 and 4 published with the responsibility and permission of the author by j.v.d.Rakt.

When the push of the arms is dominant than will the placing of the feet often not totally occur. That because normal we flex in the hip to the front and without weight on the foot they were placed, where the belong.

But pushing with the arms or assistance on the arm stop this movement to early and that create an new learning moment in the brain but also an loss of independency

Photo 6 **Photo 5**

Photo 5 and 6.
Two examples what that assistance means. Both people are through the hand- setting of the nurse stopped in his normal movement to go with the trunk to the front "past" the knee. And that will also have influence on the placing of the feet and this person learns something!
Photo 5 and 6 published with the responsibility and permission of the author by j.v.d.Rakt.

2.Mobility.

Restriction in the movement and especially in the joints are for elderly always an extra problem that asked for an adaptation. Back ward walking with an restriction in the trunk or/and the hips will asked much more from that person to hold the balance when he is walking backward. But despite this great problem, will elderly copy with this problem except when the perception and the tone are not normal.

Photo 7 **Photo 8**

Photo 7 and 8.
The mobility is restricted and the adaptation is starting long ago but the results are first-rate. The mobility of the trunk is altered and the adaptation has need of an aid but is holding their body so in control. An problem that has solve is the flexion in the trunk but that will change the perception and the motoric coordination. The pressure on the foot is now more on the whole foot and that means, that the plantar flexor muscle are more active in an standing position. But that when the walk the foot early goes to the ground to inhibit the trunk movement to the front.
Furthermore the muscle of the trunk/hip must work harder and longer to hold the trunk optimal straight. This will give perception changes in which this people haven't the feeling to walk with an flex trunk and in this picture are also their balance reactions adapt.
Normal adaptation that all elderly will undergo but when the perception and/or the tone (selectivity) is alter than this adaptation system has great difficulties. Backward falling is an sign that this adaptation has great problem.
Photo 7 and 8 published with the responsibility and permission of the author by j.v.d.Rakt.

Photo 9 **Photo 10**

Photo 9 and 10.
Adaptation of the pain in the back [24] is make always the same movement with little pain. Hold the back, in the same less painful position, an make the adaptation for the change in weight bearing in the knee and again in the feet. The heel strike will be less, because the feet must fast to the ground but with more flexion in the knee, the balance is restored. But this askes an different body perception and changing of muscle pattern [25] and with this an changing of the balance reactions. But the back is stable and less painful.
Adaptation on flex of the trunk and pain are so possible but will alter muscle pattern and the body perception and one adaptation is an high attitude tone in the muscles of the back and makes an fast relaxation and therefore the primary reaction on backward falling- fast flexion of the trunk- difficult, but still possible !
Photo 9 and 10 published with the responsibility and permission of the author by j.v.d.Rakt.

3.Tonus hyper tonus of paratonia.

The tone is often not so high and when we assess than is this by an speed that we use by the measurement of the Mas-P according the Asworth scale. [27,28]

Often is the test on the arm elbow in sitting position normal. But that isn't equal with the tone that people need to hold the standing position and walking /balance. There fore is it important to test also with more speed [28] and feel or the resistance changed. Test also the knee and feet movements.

Photo 11

Photo 11.
The test of the tone must be done in an sitting or lying position because people must relax and that isn't possible in standing position for this group.
The speed for the test of Mas-P is the same as the Asworth -scale and that is the time is the time that we count an number of four ciphers.
Test the agonist and the antagonist because paratonia has an tone increase in both muscles.

This is also the case by the rigidity by the Parkinson disease.
The problem is that we must have an relax position and the person must be capable to relax.
The term "gegenhalten" is an sign of paratonia but can also be an reaction of the person when somebody grasp his arm or his leg. Photo 11 published with the responsibility and permission of the author by j.v.d.Rakt.

When people are capable to walk and stand but have an slow balance reaction, than can an tone increase be an reason why the weight shift is an problem because this asked speed.
Is the test done with an tone that is zero or there is doubt or this tone is really zero, than increase the speed according the Tardieu scale [28]
When than an resistance occur than can this one of the reason why the balance is an problem.
Tone increase in the leg and arms will also an sign that the tone in the trunk is increase and that the synergy (pathological) has some dominancy. That means that this pattern will act dominant and that will make that the weight shift lateral is almost impossible and this group will walk with an rollator frame with an upper trunk sideway and with legs in adduction and endorotation.

There is another way to measure the tone and that is the Myotron-Pro. But the only prove we till today is that we measure the tone in stillness and not know what will occur when the speed increase. This last part will be an item that is important to assess by balance problems and also the symptoms occur by lot of people before the diagnosis Dementia is set. [30]

Important that the tone of the trunk muscle can we measured. That can we do in an sitting position through the placing technique [31]. Place your hand on the shoulder an give with the hand and verbal instruction that the person must flex the trunk so fast as possible an so far as possible. This cost some time but the reaction must be equal or faster that the time used in the Asworth scale.
This is often almost impossible because think everyone the mobility isn't present.
Than test the mobility and tone after an period of rest lying on the back and then is often the relaxation present and is the movement easy.
Do the test than again but than in sitting position and often is than there all an difference and that is the pathological tone -paratonia or rigidity.

Especially the low tone differences that we assessed when we increase the speed, is the brace that the pathological tone will give by "fast "movements.

And this will also increase the tone of the trunk and an loss of selectivity in arms and legs but in an resting situation will nobody see what photo 13 let see.

Photo 12

Photo 12.
This is obvious an higher tone and in this case it is almost for the fingers Mas-P 3. Here is almost no movement in the fingers but before that occur we see often an attitude with much more movements in the fingers as normal.
Much movements especially in the morning is also an sign that after an period of rest the limbs must be move to decrease the tone in the limbs.
Photo 12 published with the responsibility and permission of the author by j.v.d.Rakt.

Photo 13 **Photo 14**

Photo 13 and 14.
This photos let see what the performance is of two people when they perform in standing position an exercise for balance control. The goal is : " Search the end point backwards and hold that position !"
Both person are at that point and try to hold this position for 2 minutes.
See the differences:
1.Relaxation of the cervical spine is present by the lady but by the gentlemen we see an fixation. The lady can see what their feet do but the gentlemen can this not.
This because the neck muscles are high in tone an fixated this movement.
2.The spine is by the lady in an smoothly position with relaxed shoulders and nice thoracal and lumbar extension. By the gentlemen is one trunk curve that is sign that this stand fixated through the pathological tone
Photo 13 and 14 published with the responsibility and permission of the author by j.v.d.Rakt.

3.Shoulder position, compared this by the lady and by the gentlemen. The lady let the shoulder "hang" and there isn't an high tone of the scapula. By the gentlemen is the opposite, no relaxation but together with tone increase of the trunk the shoulder blade are standing in retraction and this give in the gleno-humeral joint retroflexion and in the elbow an flexion. Sign that the tone is high in the trunk from cervical -thoracal -lumbar and this isn't an "normal" high tone but here is an pathological tone active, necessary to hold control. Here we see the stiffness in the trunk that is so characteristic by backward falling.

4.The position of the hip and knee are signs that the legs must correct the attitude to hold the balance in this case not to fall to the back. And the lady is full in action on the end of their balance to the back. The white line let see how much of the body is for and back and the difference is great.
5.Feet action in by the gentlemen only an plantar flexion, maybe clawing in the toes and the exercise
was : " Go so far as possible to the back", this is the translation of the gentlemen.
The lady is on that endpoint and that seen we on the dorsal flexion in the feet.
6.Looking to the performance together with the white line gives an clear picture what the problems are of the gentlemen. That is the high tone that makes it for him impossible to control the trunk despite the adaptation in the leg but the tone in the upper trunk is so high to brace the fall to the front and then is searching for an balance to the back very difficult and asked everything of the body perception because the tone will only increase.
The stretch on the muscles in the front part of the neck is high and that can together with the high tone give problems with eating and swallowing.[33]

4.Movement training walking and trunk /hip bending.

Often the moment that tone interfere with smoothly of the movements, is the moment that an walking aid or balance aid is necessary. Often is that the rollator frame and one of the greatest advance of this device that the necessity of an higher tone isn't present.
But this device will decrease the power and coordination of the lower trunk and legs and almost always the lateral movement of the hip over the foot. That will change the perception and also the power that is present in the muscles around the hip.
The arms take an lot over but one of the movements that people not make, walking with an rollator frame, is bending through the arms and make more flexion in the trunk.
The moment that support is increasing on the arms the decrease of power and coordination in the legs go fast and this will increase the stiffness of the trunk.
This knowing must there an training program pointed on walking with an rollator in all direction and backward always with an more bending trunk.
Training of balance is of course important but when the tone is above Mas-P 1 than has this only useful when we can lowering the tone to get the necessary selectivity and that can only when the gravity is lowering (see point 7)
Training of the coordination and power must be done by task specific resistance training, that will give the best transfer and slow down the process. Here we must care that the difficulty isn't too high because that increase the tone.
We want movement against resistance within the possibilities of the person that increase the power and coordination.
We can this also do with walking behind an chair with resistance.

Pushing an chair with weight will change the posture totally from the attitude that people take when the walk behind the rollator frame.
The difference is that an chair with weight asked for an pushing action and walking with an rollator frame asked for an support on the handles to decrease the weight and coordination of the lower trunk and the legs.
Therefore pushing an chair is an treatment to slow the process.
Resistance as photo 14 can be given in all directions, therefore with great variation and stimulated the standing leg to give stability and movement to sway the swing leg.

Bending the trunk and hip is possible with that chair but with much more attributes. With the chair is simple turning the chair and walk with this with an bending trunk. But to learn how the trunk to relax can be done by bending to the sit part, but also through lifting the chair of the floor and then placing and walking with the hands on the side support or even the sitting. of course is relaxation in sit and lying position also possible but the gravity is standing position is essential to get the feeling what relaxation is. Still this tone is an pathological tone and relaxation isn't easy, stretch but also activation can give an decrease but also lowering of the gravity.

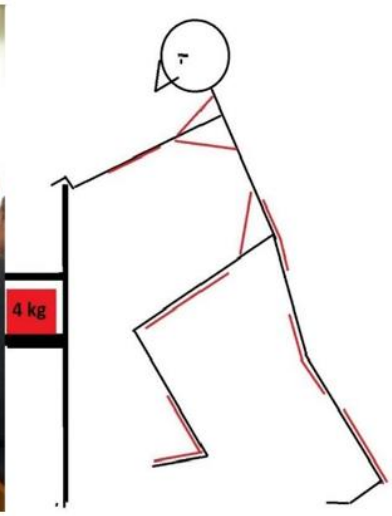


Photo 15 **Picture 11**

Photo 15 and Picture 11.
Photo 15 is an example of resistance 75% against the swing leg to strengthening the standing leg and the trunk-diagonals. Picture 11 let see what will happen and which muscles must work harder top push an chair with load over the floor.Photo 15 and Picture 11 published with the responsibility and permission of the author by j.v.d.Rakt.

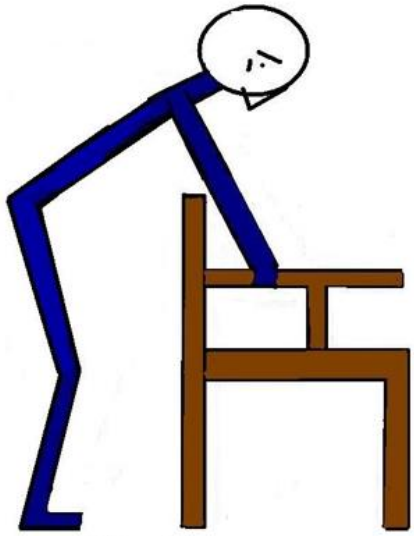


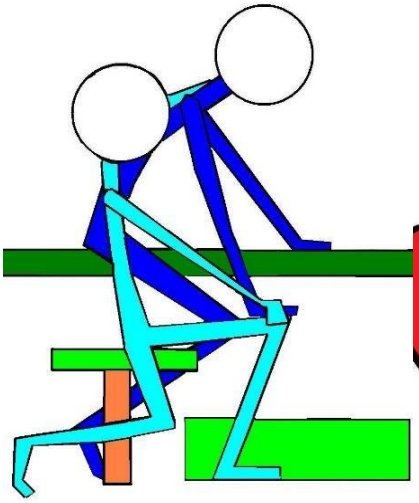
Photo 16 **Picture 12**

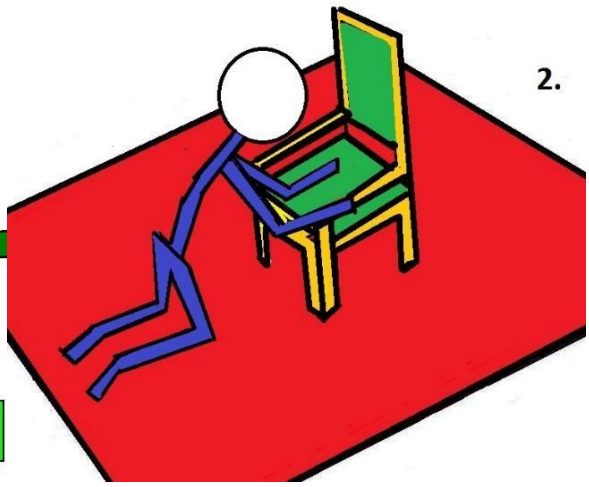
Photo 16 and Picture 12.
Pushing of an chair with load to the front. This will always lead to an greater step and more action in the front diagonals. Picture 12 gives an picture what bending of the trunk/hip give to get an tone decrease in the spine muscles.
Photo 16 and Picture 11 published with the responsibility and permission of the author by j.v.d.Rakt.

Pushing will activated an difference muscle pattern to get enough power from the trunk/legs to tha arms and get the chair in movement. Use load and calculated what the distance must be, how much rehearsal and the weekly frequency.
Muscle fatigue is an essential muscle stimulus to get an improving of the power and coordination of this muscle system.

5. Kneeling and standing up.

Elderly are afraid for falling but the reason isn't only the pain but also the fact that the are afraid that
they are not capable to stand up and that they lie for hours on the floor.
This kneeling down or losing the back can be done when the person support himself with the hands/arms and legs, than is movements between this two point possible and that can decrease the tone and stiffness of the trunk.





Picture 13 **Picture 14**

Picture 13 and 14.
Go to ground and back and always with support on the arms/hand to inhibit the tone of the spine and make movement in the that spine possible. The purpose is to go to ground and back to stand, so that this fear after falling is lesser and this is an perfect situation to control the spine movements and also the tone.
Photo 13 and Picture 14 published with the responsibility and permission of the author by j.v.d.Rakt.

Photo 17

Photo 17.
One of the main reason of backward falling is the stiffness of the trunk/hip area.
Walking will asked for this tone too control the trunk that want to fall to the front.
That process will continue and will the back muscles change and that change must be slowing done.
Exercises as bending, kneeling down and kneeling with double support is essential to hold the mobility is the back.
Photo 17 published with the responsibility and permission of the author by j.v.d.Rakt.

That there are changing in the tone, in the muscle itself [33,34], in the joint of the spine but also the shoulder and hip is certain and all have influence on the tone and stiffness.
Prevention of backward falling will never be possible for everyone, but though the treatment will there be an lowering of the danger and the occurrence.

6.Perception under the whole foot.

Till today is by neurological diseases little effect found by training of the disturbed perception [35]. This comparing with the motoric approach was the conclusion that the motoric approach has an better effect also on the restoration of some body perception (total and local). At this moment is the activity the best perception treatment but by elderly with dementia is also damage in the cortical projections. The motoric performance will be alter through the tone and that will also have an influence on the body perception. Or is an lower perception the reason that the damaged brain seek for an solution and is that the use of pathological synergy with paratonia.
When we task specific resistance training apply with load will this also stimulated the perception of the body through the load will this give more body information in the brain.
Other alternative is water that gives through the hairs much more information that can influence the perception projection in the brain and that with an decrease tone.

7.Hydrotherapy.

The combination of the stiffness in the trunk/hip through the high tone and/or pathological tone (paratonia) and the restricted or even wrong body perception asked for an situation that can solve some of the problems.
Hydrotherapy can solve an few problems and create an environment that stimulated movement. This because moving in water give people an surrounding that support them and will brace the falls but has also an positive effect on the tone because the gravity is reduced [36].
This all together with an good program of balance training will give elderly with and without dementia the possibility to control the trunk/hip movement/mobility and will there help the weight bearing increase over the whole feet and will inhibit the “wrong “perception that we say when elderly start their balance to the back when the weight is passed the heel.

Conclusion.

Backward falling is dangerous but on the other hand often present after an few steps to the back and can lead to trauma from legs, spine to the head.
Robinovitch team show that this occur the most in long car facilities and that this also occur with an walking aid.
We investigated what the reasons could be that caused this incapacity to walk back and not control the balance properly. This reasons were often and the stiffness of the trunk/hip and the body perception.
The awareness where the body is in totally but also where the weight on the feet were. By back ward falling was remarkable that the reaction occur often too late. When the weight was behind the heel than the reaction get starting and that is too late.
Further was the stiffness in the trunk/hip often high and was the reaction of the trunk to the front slow and that makes an step strategy no chance also because the trunk movement to the front facilitated the free leg to the back.
Still there are possibilities to slow down this process by an treatment that take care for trunk mobility and train the correct movement with an good perception.

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