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Rehabilitation of Patients Suffering from Parkinson's Disease by Normotensive Therapy

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1. Introduction

Neurodegenerative injuries lead to disabilities, such as sensory and motor disturbances, with patients often losing their balance, and falling as a consequence. Moreover, capsulo-ligamentary adhesions often occur, which create stiffness and secondary retractions due to the lack of mobilization of the periarticular structures. These complex clinical pictures, when interlinked, are even more important when simultaneously the patients suffer from recurrent diseases, such as degenerative rheumatism.

Parkinson's disease, this public health issue, is evaluated through clinical criteria, as there are as many forms of Parkinson's disease as there are various cases. Personalized and adaptable physiotherapist option is therefore necessary. The syndrome associated with Parkinson's disease is characterized by a motor disorder, an akinesia combined with one of the following symptoms: extra pyramidal stiffness, tremor and postural instability. A depressive syndrome, a cognitive decline, and more or less disabling pain, come on top of the clinical picture. The patients frequently suffer from cramps or painful contractions, which mainly affect (74%): calves, neck, lumbar rachis, and which are more or less combined with dystonia. Comorbidities make the treatment even more complex. And it is always difficult to know, when considering the symptoms and their origin, whether it is Parkinson's or other illnesses which are to blame. These comorbidities should always be taken very seriously, and be properly treated, as they have an influence on the patient's mobility fluctuations *(1).*

Normotensive Therapy reinitiates the movement, it treats stiffness, pain, and lack of mobility. 68% of patients, whatever the stage of the disease they are in, suffer from concomitant illnesses such as: arthritis which can affect shoulders and knees and make the postural syndrome even worse, undefined chronic pain, arterial hypertension or heart pathologies. Unfortunately taking drugs often triggers rheumatism symptoms, and either contributes to their development, or keeps them going and makes them worse *(2).* The drugs intake is, on top of that, one of the main risk factors of fall among the elderly, and therefore complicates the rehabilitation. These drugs intake is a real risk factor whatever the patient's residence, autonomy and independence level are, as it underlines poor health condition and pre-existent fragility. The drugs classes which are mostly to blame are :

psychotropic substances (most of the time the first to be cited), as well as hypnotic, sedative, antihypertensive, antalgic and opiate drugs (3).
Mepronizine, a treatment for accidental insomnia, is to be avoided in the elderly, especially when over 75 years old, as it may cause falls and intoxications. At the opposite, some other drugs like Dopamine might help the patient suffering from Parkinson's disease, especially at the beginning of the illness as it has a protective role, which is not so obvious when the illness is more developed.
An increase in the L-Dopa dose, the first intention drug, might lead to motor fluctuations after a two year treatment, such as diskinesia and akinesia.
Furthermore, the end of dose of L-Dopa is to be taken into account versus akinesia *(4).* A well trained Normotensive Therapy physiotherapist will consider the stage of the patient's illness before making his choice among the different maneuvers. Should the Physiotherapist consider a maneuver for the patient, if it proves inadequate, he would easily switch to another one. For example, he could switch from an active exercise which involves the patient's participation to a passive and gentler manoeuver. The NT (Normotensive Therapy) is a very adaptable physiotherapist option, but it requires the patient's total acceptance, in order to avoid situations of conflict which might cause confusion and/or diskinesia. The NT must be carried out at fixed time, so that the patient is physically and mentally well prepared, and available (never disturb a family visit for instance, wait until toilet is over). The NT will be more effective in favorable conditions: correct heating of the room, well adapted clothes and shoes. The after-meal times should be avoided as the digestion might disturb the course of the exercises. Abrupt exercises are to be avoided.

2. Successive stages of the illness

Parkinson's disease takes on three different main stages: the honeymoon period, the stage when the illness gets settled, and the dependency stage.
In the initial phase of the illness, the symptoms are usually mild and the NT attempts to keep and reinforce the patient's balance, while trying to improve the pain and functional impotency resulting from degenerative rheumatism. Back pain is frequently shown as the main preexisting handicap, often disturbing the thoracic amplitude and therefore the cardiorespiratory system.
In the second phase, and during the "on" period, the patient's balance will be improved by exercising on the Klein balloon, wearing an elastic bandage for other specific exercices, and by foot-stimulation with TENS (Transcutaneus electro-neuro-stimulation) as described further on (new treatments). The patient will be encouraged to keep a straight and upright position as long as possible, and the NT will help the joints to stay supple and the breathing to keep its former amplitude thanks to anti-kyphosis and anti-flessum NT maneuvers.
During the "off" period, the postural, articular, and muscular pain increase, due to motor deficit, depressive syndrome, and medication (5) . That is why it is very important to keep using the Klein balloon during that period (under supervision) while the patient's physical movements are usually limited. The physiotherapist will try to make the muscles relax in order to facilitate the movements and the NT maneuvers will deaden the pain.
In the third phase, when the dependency becomes complete, the physiotherapist will try to prevent the patient from becoming utterly bedridden, in carrying on NT maneuvers (relaxing maneuvers), and the pain treatment. An appropriate use of the Klein balloon in handicapped patients, will be encouraged under strict supervision.

3. The *Normotensive Therapy*: An alternative method to reinitiate the movement

NT is not a medicine, although it depends on a personalized morpho-staturo-dynamic examination. It is based on a medical diagnosis, and is carried out in close collaboration with the medical staff (general practitioner, psychologist, nutritionist, occupational therapist, speech therapist, relaxation therapist). NT is not symptomatic and treats the whole body, focusing on zones which seem essential to treat, even if these zones have not been mentioned by the consultant.

Two main poles of intervention :

1. Atraumatic manual normalization of the tissues which should correct stiffness and allow mobility to be restored without any pain.
2. Control and correction of the posture thanks to specific exercises.

The NT is a manual atraumatic therapy with no articular thrust beyond physiological amplitude. It is an important source of somesthetic afferences, as the patient suffering from Parkinson's is particularly receptive to the neuro-informational sensory component of this kind of specific massage.

The word "Normotensive" is a contraction of two words: "normalization and tension". It is a myofascial and neurosensorial therapy which doesn't imply hooking the tendons. During the session, the patient is kept in an active postural activity all the time, the passive maneuvers on the tissues being carried out before and after the exercises. In the Parkinson's case, NT helps restore scapulothoracic mobility, reduce kyphosis, improve ventilation often disturbed by thoracic tightening, and improve the functional clinical picture: postural reactions, balance, walking. It treats the pain due to bad postures, or the after-effects of concomitant disorders such as degenerative rheumatism. No excess stress or fatigue can arise from NT, as it is quite a soft therapy.

The manual normalization of the tissues depends on two maneuvers: *the triggering touch* and the *relaxing touch*.

These maneuvers are not to be carried out in case of inflammation or injuries whether superficial or deep.

3.1 The triggering touch

It is a sustained vibrating proprioceptive therapeutic maneuver, which is less than one minute long, and can be manual (most of the time) or instrumental, according to two distinct methods. In the Parkinson's, the plastic hypertonia expresses itself in a resistance to the passive stretching of the muscles. It is therefore essential to control the muscular contraction, so that it is more effective, and the *triggering touch* is part of it, being a soft stretching method encouraging the muscular relaxation. Indeed, in central neurology, the response to the vibrations is more easily recognized than some other finer tactile perceptions.

The *triggering touch* is based on two methods:

The first maneuver called *static triggering touch*, aimed at the soft tissues. It is a long lasting transcutaneous vibration under soft traction of the dysfunctional myofascial structure.

The vibratory intensity is modulated according to the local thickness of the teguments, to the more or less deep situation of the above-mentioned soft tissues, and to the wish not to be algogenic.

The second maneuver called *dynamic triggering touch*, aimed at the joints. The physiotherapist will give the regarded joint a soft passive vibratory movement of limited amplitude (flexion-extension, rotation, or adduction-abduction, according to the contingent possibilities). If possible this gesture is backed up by a very gentle segmental traction-decoaptation.

Tissue traction

In order to properly understand the interest of the superficial tissue traction, let's cite *Rabishong:* "the identification of rachidial posture and position is made by tractions on the skin". This traction gives to the central nervous system a feeling of muscular stretching. Then, the vibration made on highly tendinous zones, makes the treated muscle relax by activation of the antagonist (Sherrington Law).
Besides, the Golgi tendon organs, neuronal endings surrounded by a connective capsule, are situated at the junction between the smooth muscle fibers and the tendinous tissue. The Golgi tendon organs, could help monitor muscle strengths in order to fight gravity. Mechanoreceptors, Ruffinian corpuscules, Golgi corpuscules, are situated inside the articular capsules and the ligaments. And this is precisely where the NT is efficient.

Vibrations

Vibrations have been used since antiquity as therapeutic means. Transcutaneous mechanoreceptors are very sensitive to transcutaneous vibrations. These vibrations result in a mainly sensorimotor neuronal message, facilitate the sliding plans, relieve the pain, and reinforce the *gate control* (6). The primary endings of the neuromuscular spindles are activated too, especially when the source of the vibratory impact is close to the tendons. So, proprioceptive information can easily be rigged by a vibration, and this one, if its intensity and frequency are well adapted, leads to a modification in the information coming from the fibers Ia, and therefore will be read by the neuronal system as a muscular stretching (7, 8, 9). This misinterpretation from the central nervous system gives the illusion that the joint is moving, and that the vibrated muscle is contracting, which leads to a change in the patient's postural control. Using this information, several studies have analyzed the effect of a vibration upon the muscles of different joints on the postural control (10, 11, 12). Results show that the nervous system interprets the signal coming from the vibrated muscles differently according to its location. Applying a vibration to the pelvic limbs leads to corrective reactions from the whole body in an opposite direction of the perceived movement, whereas above the pelvis the reaction occurs in the same direction as the perceived movement. For some authors (13, 14, 15), this is due to the strong interaction between the vestibular and proprioceptive cervical informations while the information is being treated by the central nervous system, because of the necessity to know the relative position of the head and the trunk to use the vestibular information in a satisfying way. For other authors (16, 17, 18), it is due to the functional role of the proprioceptive messages coming from different body parts. For instance, it is possible to give a function of opposition to the destabilization of the body to the proprioceptive messages coming from the lower body, whereas they give the function of orientation of the body to the information coming from the cervical region. These items of scientific research help the Normotensive treatment determine how to correct the posture. They always involve a cephalocervical treatment.

3.2 The relaxing touch

It always takes place after the triggering touch and takes into consideration the fact that a disruption in the articular micro-movements leads to a loss of performance in great amplitude movements. The *relaxing touch*, according to two modes, will allow the tissue mobility to be restored and the pain to be soothed, by working on the *tensive lesions*, a few millimeters long pathogenic threadlike cords, or tight strings. In case of a skeletal muscle being contracted, they are very easily recognizable in a softer surrounding myofascial structure. It is explained by the comprehension of the myotatic reflex, and of the effect of the motoneurons. The alpha and beta motoneurons, are equipped with an inhibition system called recurrent inhibition. Golgi receptors which are scattered at the muscle-tendon or muscle-aponeurosis junction, are receptive to their stretching. They have a direct role in the control of the contraction and in the feed-back of the normal myotatic reflex. And this zone is precisely the one which interests the NT (19). Furthermore, about the nature of the collagen, the late Eric Viel used to describe an ogive shape which overlaps, with *cross-linkage* contacts between the fibers beams. These *cross-linkages* can turn into points which become hardened because of: an immobilization, an attitude syndrome, a trauma, or any deep or superficial injury. The great anatomist Xavier Bichat used to call these *cross-linkages* : "hardened tissues". The stiffness of the collagen tissue being a sign of ageing, and making the spine tissues harder. The physiotherapist fingers, used to the NT, can detect these points where collagen sticks, and set it free (20).

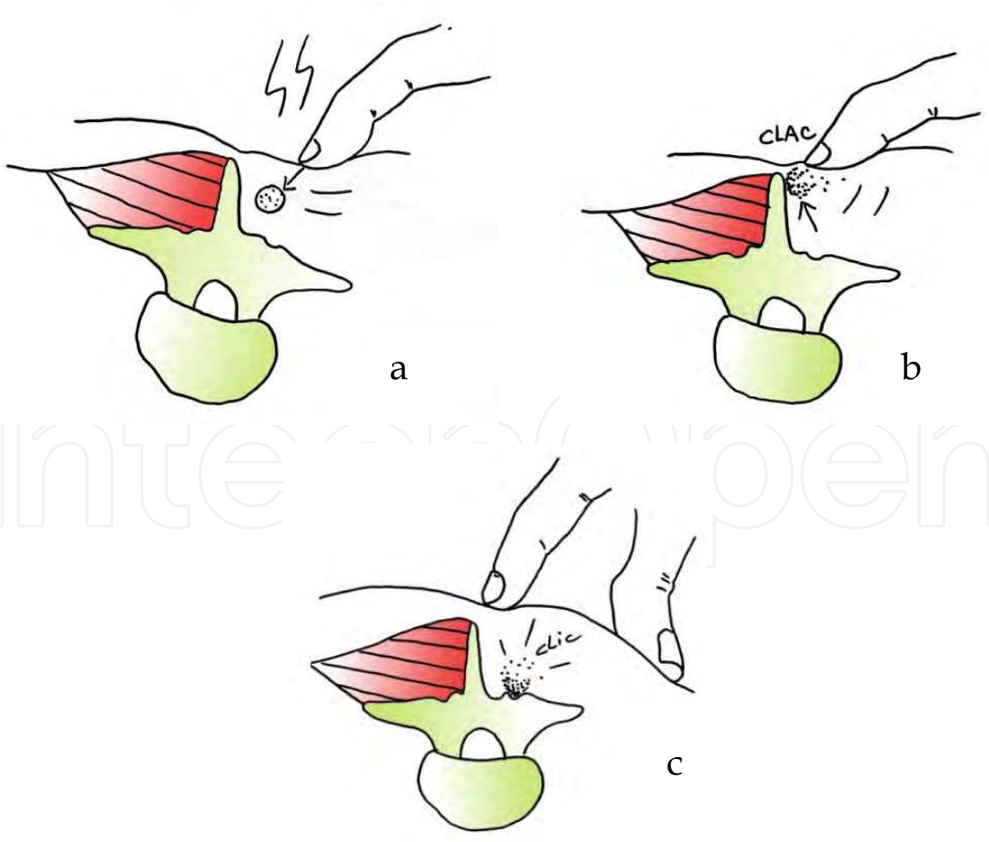


Fig. 1. The two modes of the *relaxing touch*

When they are close to a bone relief, the physiotherapist sharply pushes away the *tensive lesions* against this bone (Fig 1, a). He crushed them on the bone and makes them crack (Fig 1, b). If there is no close bone relief around, the therapist strongly squeezes them between thumb and index, as if they were a guitar string. This gesture is to be made two or three times at a go.
The second gesture consists in making the treated soft structures bulge while vibrating. It looks like the "roll and lift" method, but it is longitudinal instead of being transversal (Fig 1, c). It aims to make the tissues become detached, and to allow them to slide on each other again.

4. Control and normotensive postural corrections

4.1 The functions of the postural system

The sensorimotor control of our postures and movements, is subject to fluctuations in the course of our existence. Unfortunately, it turns out not to be very effective for most people, whether they are ill or not. Should this control be disturbed on a long term basis, some signs might appear such as: tiredness, pain, tendonitis, degenerative arthralgia, discal hernia. Four sensorial entries are mainly to blame: internal ear, podal afference, vision, jaw.
Very soon in life, from the age of 35, the postural extensive muscles weaken, which leads to some difficulties for the rachis to adapt to verticality. Besides, when an elderly has a bad fall, his balance can be definitely disturbed (clinical picture of "post fall" and dysexecutive syndrome).
In the Parkinson's disease, where sensorial afferences are highly disturbed, especially the graviceptive somesthetic information, it is essential that the balance be taken therapeutically into account. The habits in the use of the body are progressively disturbed. If the patient is elderly, myogene or neurogene atrophy can occur and lead to a muscular unbalance, whatever the gravity of the illness.
The human motor behavior is organized in reference to a biological vertical line, which is built by the brain from visual and graviceptive informations (otolithic and somesthetic). Evocating the notion of position in an environment implies a system of reference. The system of reference based on the gravity vertical line, is mainly informed by the vestibular system, whereas the one which is based on landmarks in the space is mainly informed by the vision. As for the one which is peculiar to the individual, it is based on information coming from the somesthetic system (one of the base of the NT treatment).
The search for balance is the decisive factor of the postural control. Some cerebral injuries can alter the ability to keep a certain position, or to change it, in the three fundamental postures: reclining, sitting and vertical position. Sometimes, serious abnormalities of the sense of verticality can occur from a tactile, visual, or postural perception of the vertical line. In neuronal (or vestibular) pathology, the abnormalities of the subjective vertical line consist in the existence of a slantwise direction, and/or an uncertainty about the verticality. Any cerebral injury concerning a zone which is involved in the graviceptive vestibular or somesthetic perception can lead to a disturbance in the construction of the subjective vertical line. An injury of the vestibular tracts affecting the graviceptive somesthetic tracts will give an angle to the subjective vertical line concerning the postural perception of the vertical line. The posterolateral thalamus is not only an intermediary for the vestibular tracts, but it could be a fundamental structure for the control of the upright position as well. In the patients suffering from Parkinson's, the postural mode of the subjective vertical line is disturbed.

The vestibular, somesthetic, and visceral graviceptors, contribute to the actualization of this subjective vertical line (21).
However, if the contribution of the visual and somesthetic information to the control of the biped posture is well determined, the one regarding the vestibular informations remains a controversial issue. A study mention sensitivity thresholds of the upper semicircular canal, to the quickening of the classic postural fluctuations observed in an undisturbed upright static position (22).
Our tactile sensitivity is conveyed by different mechanoreceptors (Meissner, Pacini and Ruffini corpuscules, Merckel discs…). They provide informations about the outer world to the central nervous system, mainly thanks to the hands and the feet. That is why the NT is seriously taking them into consideration. The tactile receptors of the plantar sole are quite important, but the other cutaneous informations should not be overlooked. From feet to head, the continuity of the sensorial information which allows our balance, relies on numerous muscles and joints which are associated in chains. The plantar arches give informations about the variety of supports, eyes give information about the position into the space. There is a direct link between jaw and neck, and between eyes and neck muscles. The stability of the head relies on the balance between the jaw joints (23). Some scientific studies suggest, on the one hand, that the central and peripheral visions play a complimentary role in the control of the biped posture, and, on the other hand, that the relative contribution of each of these visions depends on the information given by the other sensorial systems, especially the somatosensorial informations coming from the foot-ankle segment (24, 25). If the sensorial captors are situated in different parts of the body, the information they provide converge to common cortical or subcortical structures, which control the postural system through different reflexes. The vestibulo-ocular reflex allows the stabilization of the eyes, the vestibulo-spinal and vestibulo-oculo-cervical reflexes allow the global control and the maintenance of the posture by their action upon the myostatic reflex.
In the patient suffering from Parkinson's, the visual stimulation is usually shown as being supportive to the reconstruction of the motor activity. Nothing is less certain. The whole day long, the patient is aware of the risks due to his pathology, and the result is not conclusive. The movements with the eyes open are inefficient and ill adapted to the real needs of the patient, who is under constant stress while performing his daily routine. During the NT session, the vision is sometimes occulted in order to reinforce the patient's confidence in his other senses, as he often perceives the environment as hostile and full of potential and insurmountable difficulties. It is not possible for the patient to control everything: balance, postural correction, lengthening of the step. If the eyes are closed, and the therapist around, the patient can relax and focus on the reinforcement of his other senses, which later on will allow him to adapt better to the variations of his environment. In his everyday life, the extrinsic factors which are factors of falls such as: faulty lighting, carpets or furniture, will be more easily grasped, the vision becoming an asset adding to the other reinforced senses, instead of just being a substitute.

4.2 Posturo-normo-regulator examination

It is inspired by the medical clinical examination, and by the anamnesis. It is important to appreciate the comorbidity which could alter the conclusions of the examination: medical history of cardiovascular accident, heart failure, myocardial infarction, infectious illness, hypoglycemia if diabetic patient. The posturo-normo-regulator examination involves many

maneuvers, which cannot all be mentioned in this paper which does not aim to be exhaustive.
The patient is examined when in underwear. The examination should not be more than 5/10 minutes long, as the patient will rapidly adopt wrong corrective postures which will alter the conclusions. It is important to look for faulty postures and maladjusted movements which might pose problems.
The examination regarding the balance control consists in checking the patient's ability to stay in a stable position when sitting, then standing, with the eyes wide open, then closed. The static and dynamic bipodal then unipodal phases are assessed (there is an abnormality if the patient cannot stand more than 5 seconds on his favorite foot, with his eyes wide open (26). The *Get-up-and-go test* consists in asking the patient, sitting on a chair which is 3 meters from a wall, to stand up, stay immobile for a few seconds, walk up to the wall, turn round and go back to the chair and sit again in no particular hurry. Between the age of 65 and 85, it normally takes the patient about 12 seconds to perform the exercise. If the exercise takes him more than 30 seconds, the patient is said to be highly dependent. The inability to stand on one foot for less than 5 seconds is said to be pathologic (27).

4.2.1 Postural bearing test

It aims to detect the degree of global corporal instability. This test is to be carried out both at the beginning and at the end of the physiotherapy session. The end of session test is expected to be better than the one carried out at the beginning of the session. In case it is not so, the following session must be optimized by either changing the time of the session, or by reinforcing the balance control exercises. All these sessions will be interrupted with NT normalization of the tissue maneuvers.



Fig. 2. Postural bearing test

The patient is standing up, eyes closed. Without any warning, the therapist is exerting a thrust in the popliteal space. The therapist can check the reaction of the different body segments, and then evaluate the restoration of the balance component, and the arms swing (Fig 2).

4.2.2 Test in the trunk diagonal with focus on the fluctuating effect

It is about the closing chain of the locomotion muscular chains, and it tests the mobility of the scapular and pelvic belt with each other.

This examination is to be carried out on both sides, as a comparison test. The therapist lays one hand on the patient's shoulder, and the other one on the opposite hip. Then he exerts a sudden thrust with his two hands, in order to test the articular mobility. For instance a thrust on the shoulder may harmoniously drag down the lateral hemithorax, whereas the opposite hip remains blocked in the high position, which evokes a flaw in the lombo-pelvic cinematic (Fig 3).



Fig. 3. Test in the trunk diagonal with focus on the fluctuating effect

5. Rehabilitation

In the patient suffering from Parkinson's, the poor speed and amplitude of the movements are to be seriously taken into consideration before any other parameter. The NT treatment is a combination of different balance control exercises on a Klein balloon and when wearing an elastic bandage, and also normotensive correction of the tissues carried out either before or during or even after the exercises. The sessions must be quite short in duration, interrupted with phases of rest. It is indeed important to hold the patient's attention during the session and even to make sure he enjoys it.

5.1 About the obstacle of dystonia

Dystonia is movements in profusion which is difficult to control. When walking, the patient takes long strides and swerves, and might easily fall. However disturbing they might be, this dystonia should not prevent the rehabilitation session to be carried out in a satisfactory

way, even if they are painful or if they disturb the patient's balance because of their impact on the joints, or on any other body segment.
If the exercise in process is definitely disturbed, it is then necessary to carry on the session with other active or passive maneuvers, and to come back later on to the previously planned exercise, at a more convenient time.

5.2 The walking ability

We know that some factors predispose to falls, such as : being over 80, being a woman, depressed, suffering from a loss of strength or a bad coordination of movements, or from feet abnormality or ill-fitting shoes. In the patient suffering from Parkinson's, the main problem with the walking ability is that not only is the walking faulty, but it moreover lacks stimulation. Over the years, walking becomes slower, with a shortened step, a lengthening of the time when the two feet are supportive, a loss in the arms swing, and a tendency to stand with the trunk leaning backwards (28).

5.3 Improvement in walking by foot stimulation by TENS (Transcutaneous electro-neuro-stimulation)

Most of the patients suffering from Parkinson's are suffering from their feet. As a consequence the neuro-informational podal component, which is essential to the balance control, is disturbed. This leads to falls in the patients. However it is possible to improve the postural vertical component, thanks to a low frequency ambulatory transcutaneous neurostimulation. This stimulation improves the foot somesthetic perception. It stimulates the walking. The power reinforces the foot afferences, giving the patient a better perception of the support.



Fig. 4. The electrodes are installed in medioplantar. The stimulation must not be excitomotor. The power must be of a low intensity, just enough to be perceptible, and no algogenic. If one of the feet is less responsive, we must increase the stimulation on the less responsive side. It is possible to vary the treatment, for instance in stimulating only one of the feet, or in modifying the electrodes position, in order to get a better motor reaction.

5.4 Exercices and walking with an elastic bandage

It has been proved that wearing elastic adhesive bandages on different body parts, or Velcro bandages, could increase the intensity of tactile informations (29, 30). Taking this information as a starting point, I had the idea to initiate the occasional wearing of an elastic bandage (60mm wide coarsely woven flat elastic band, 10 m long roll), to be worn directly on the clothes. It is especially recommended in case of: weakness of a lower limb, osteoporosis, arthritis, backache, very old age, Alzheimer, hemiplegia, Parkinson's. This extensor system allows the patient to better apprehend his body from every angle. It helps him to feel the joints interaction, forces him to stretch his body, encourages the proprioception, and re-educates the vertebral erectors in restoring the balance of the chains of movements. In the Parkinson's case, the equinism of the ankle pushes the patient back even more. The elastic bandage partly makes up for that. It must be on while exercising, and even for a few hours a day if necessary. It is not to be kept on too long, nor when sleeping, sitting, or lying down.

Place the elastic bandage in the middle of the foot, and then pull it up to the shoulders, folding it tightly and firmly across the body. (Figures 5, 6, 7 and 8)



Fig. 5. Standing up after sitting. To restore the gravity line forward (its tendency being backward), the patient pull on his "suspenders".



Fig. 6. Putting forward an upper limb or exaggeratedly lifting a lower limb, in making sure the movement doesn't push the patient backward, might be enough to initiate the step. The patient is asked to pull on the elastic bandage as he would do with suspenders (that he should wear later on, for the same use). When stepping over an obstacle, it is first the therapist who pulls on the bandage to help the patient move, and then it should be the patient himself who does it, as soon as he/she is able to.



Fig. 7. Half a turn, initiated by the therapist (then by the patient), in waddling alternately to the left and to the right, in order to alight the body weight so that the foot can move forward



Fig. 8. Harmonization of the movements of the shoulder and pelvic girdle, during the moving

5.5 Specific exercises on the Klein balloon

"An active sitting position should be encouraged whereas a passive position should be avoided !"

Generally speaking, we should all sit on a balloon instead of using a chair, as a passive sitting position is very aggressive for our back, alter our balance, and doesn't make sense on the postural point of view.

A posture which is too long maintained is always harmful, especially when regarding elderly people or people who seldom move. It is the same problem with the patients suffering from Parkinson's. The elderly women who spend more than 9 hours a day sitting have one and a half more risks of suffering from a broken hip than the women who sit less



Fig. 9. Exercise of transfer of the body weight from one foot to the other one, a phase which is essential for the initialization of the step. The therapist can give a rhythm to the exercise. For example he claps his hands to help the patient change his support, and the exercise can be carried out more or less rapidly



Fig. 10. Make a ball roll on a long table when walking alongside it. At the end of the table, change hands and go back to the starting point. Accelerate the pace progressively

than 6 hours a day (31). Unfortunately elderly people are most of the time made sitting in a chair the whole day long, especially in old people's homes. Because of that, the motor deprogramming is quick which makes the rehabilitation even more difficult. It would be much better to encourage the elderly, if their health condition allows it, to sit on the Klein balloon in order to reinforce their balance.

In the case of the patients suffering from Parkinson's, the balance of the head, as well as the setting of the body weight forward, should be thoroughly checked, as the akinesia leads to the gestures being scarce, to the body coiling itself up, and to retractions. The exercises while sitting on the balloon, backed up with manual maneuvers, try to make up for these problems.

6. Normotensive normalization of the tissues

The patient is checked according to the pattern of the above-mentioned posturo-normo-regulator examination. And then early corrective manual maneuvers are carried out for quite a short time (about ten minutes). Next, the patient performs some exercises on an oscillating board, with the eyes closed, for the same duration. Eventually, following a new normo-postural examination, ultimate corrections are made.

6.1 Example of manual treatment

The Normotensive Therapy is quite rich in different maneuvers and the therapist can pick up any of them , according to the specific need of the patient.

Here are some of them:

In this example, the patient shows up with a fixed facies. The walk is awkward: bent shoulders, accentuated cervical lordosis, accentuated and stiff kyphosis which lead to

cervical and scapular bilateral pain. Furthermore the right ankle is scarcely mobile which causes the support to be faulty. The thoracic expansion is limited, and the respiratory amplitude affected. The patient can easily fall. In the Parkinson's stiffness very usually predominates on the flexors, when in flexion.

6.2 Myofascial Normotensive treatment

6.2.1 Treatment of the facies

There are close links between cervical biomechanics and manducator function. Only if the jaw joints are well balanced can the head remains stable. If the patient shows a fixed facies and a poor facial expression, it is necessary to treat him in order to soften the expression. The manducator function is quite important for the general balance of the body. The very specific NT massage increases the biting force and allows the peripheral muscles of the neck to relax, while they usually make the patient adopt a very poor posture in the severe phase of the illness. It has been proved that vibrating friction massage could improve the biting force (32).



Fig. 11. Treatment of masseter muscles

This treatment mainly applies to the masseter and lateral pterygoid muscles, very much involved in the dysfunctions of temporo-mandibular joints.

The patient is asked to firmly and quickly close his mouth, whereas the therapist tries to prevent the movement with the tip of his fingers (Fig 11). Next the therapist carries out a *triggering touch* without the patient's participation, with thumb and forefinger first joined together, then, moving apart from each other, several times at a go. Maneuver to be carried out on both sides.

Then, the patient is asked to move his chin sideways, in opposition to the treated muscle while the therapist prevent the movement, and then carries out a *triggering touch* in separating thumb and forefinger on this muscle(Fig 12). Maneuver to be carried out on both sides.



Fig. 12. Treatment of lateral pterygoid muscles

6.2.2 The Twist maneuver

It is a global NT maneuver which aims to the softening of the vertebral column.



(1) (2)

Fig. 13. The *twist maneuver*

The patient puts his shoulder forward and raises his knee in a rotary outward movement, whereas the therapist resists it (Fig 13 -1). Next the patient relaxes and follows the therapist who triggers a spiral movement while firmly holding the pelvis which must remain immobile (Fig 13 - 2). Maneuver to be carried out on both sides. If it is only a thoracic amplitude gain which is to be obtained, the hand which holds the pelvic should be placed slightly higher.

6.3 Cervical treatment

The cervicothoracic treatment always comes before the treatment of the shoulder as it relies on it. The balance of the head is to be thoroughly monitored. The cervical rachis should be softened, functional, and harmoniously following the eyes, as the vestibulo-ocular and

vestibulo-oculo-cervical reflexes have an important role in the preservation of a correct posture.



Fig. 14. *Dynamic triggering touch* on sternocleidomastoid muscle

The patient is in decubitus. The therapist resists to a contraction (isometric movement) of the muscle in rotation of head and neck, of the opposite side of the contraction (sternal head), and then in homolateral inclination (clavicular head). Next, he pulls on the extended muscle by a soft occipital traction, while gently rotating the head to and fro (Fig 14).



Fig. 15. Cervical maneuver in *nutcracker*

The patient is in lateral decubitus (Fig 15). He is asked to raise the shoulder three or four times, slightly backward, in opposition to a manual resistance (isometric movement). Next, the therapist makes the superior trapezius muscle stretch with hands apart, while simultaneously carrying out a static triggering touch with both hands. And then he carries out the same *static triggering touch*, then *relaxing touch* on the scapular insertion of the levator scapulae muscle, after the shoulder blade has been raised in the opposite direction. A regional *relaxing touch* is then carried out if needed, especially if there are *tensive lesions* left, the therapist's hands being placed the same way.

6.4 Thoracic treatment

Although deformations appear quite late, emphasis must be put on their prevention. Moreover, there is quite frequently a feeling of thoracic oppression occurring during the periods of *block*. Spinal or scapular pain often occur at the same time.



Fig. 16. Vertebral thoracic treatment

The patient is in lateral decubitus, with his back bent (Fig 16). While he is breathing out, the therapist's hands, moving apart from each other, exert *triggering touch traction* along the paravertebral thoracic muscles, on the side which doesn't lean on the table. At the same time, his knee placed in the thoracic zone exerts a pressure so that the treated zone is stretched. A relaxing maneuver is to be carried out if *tensive lesions* are detected. To be repeated in the opposite lateral decubitus.



Fig. 17. Costal treatment

The therapist puts his fingers successively in each intercostal space, insisting on the area where the thoracic expansion is limited (Fig 17). The patient is asked to "breathe inside his ribs". The therapist carries out small stretching movements in *triggering touch*, with the hands moving apart while the patient breathes out.

Then, relaxing treatment, if necessary, mainly in the posterior thoracic zone, near the vertebras.



Fig. 18. Shoulder treatment

The patient being in dorsal decubitus, the therapist keeps stretching the upper limb of the patient along his back, while he gently pulls the head of humerus in decoaptation with his thigh (Fig 18). He uses the heel of the hand to push backward and downward the head of humerus with a *triggering touch.* This maneuver which is never painful, is to be repeated for two or three minutes at a go.

6.5 Lumbar treatment: Specific treatment of Iliopsoas muscle

The Iliopsoas muscle is often to blame in any lumbar mechanical pathology, even sometimes the only one to blame. It is necessary to check it or correct it, if necessary.
The patient finds it difficult to straighten up. His muscles are stiff and hypertonic, partly because of his posterior muscles "in flessum".



Fig. 19. Lumbar Iliopsoas treatment

The patient is in decubitus at the end of the table, with the thigh folded on the abdomen (Fig 19). The therapist tests the elastic resistance of the two Iliopsoas through a palpation of the abdomen (inferolateral part of the abdomen, rectus abdominis excluded) with the patient's hip bent in opposition (isometric movement), his hand being below the groin fold. And then he treats the lesional Iliopsoas: the patient bends his hip against resistance, the other being tucked up on the abdomen, and the therapist carries out a *triggering touch*, with both hands vibrating at the same time.



Fig. 20. Lumbar Iliopsoas treatment

Immediately after the maneuver before, the patient positions himself in laterocubitus, with the trunk in rotation (Fig 20). On the side which is to be treated, the thigh is kept in extension. The patient bends his hip (isometric) with opposition from the therapist, and then the therapist carries out a *relaxing touch* on the patient's lumbar rachis while pushing his shoulder back to the table.

6.6 Tibiofibular treatment

Treatment of the tibiofibular syndesmosis when blocked, in order to ease the flexion-extension movement of the ankle and to restore the support.



Fig. 21. and 22. Tibiofibular treatment

The patient is sitting on the Klein balloon (Fig 21, 22). He makes it roll from right to left (so that the ankle is mobile, which is the dynamic element of the maneuver) while the therapist carries out a *triggering touch* on the tibiofibular syndesmosis, followed by a *relaxing touch* if needed. It must lead to a mobility gain in the flexion-extension of the ankle. Otherwise, the maneuver must be repeated.

6.7 Minor joints

The different rehabilitation maneuvers often overlook the minor joints. However, the illness seriously alters the way they work, which can handicap the patient in all his daily activities, so he ends up forgetting to use them. Thanks to the NT, he realizes how important it is to reintegrate them in his body scheme, being aware that taking care of them will give him back a freedom of movement.

The tactile foot captors give very valuable information on the body oscillations in relation to the vertical line. However the skin sensitivity decreases over the course of years, and it can alter the balance, especially in the case of Parkinson's disease whereas it is important to keep a good support.

The graviceptive somesthetic tactile information brought by the *triggering touch* on the plantar soles, improves the patient's postural stability. Each session should include a *triggering touch* on the plantar soles just before the equilibration exercises on the oscillating board. When the skin receptors are stimulated by vibrations, the control of the biped posture is improved.

The patient is sitting on the balloon. He bents the hallux against slight resistance, then the therapist exerts a traction in line in *triggering touch.* Again the patient is asked to bend the hallux against resistance (Fig 23). Then, he can relax whereas the therapist keep the hallux bent while he carries out a *triggering touch* on the upper side of the joint. The maneuver is to be repeated between the proximal and the distal phalanges.



Fig. 23. *Triggering touch* on the hallux between head of first metatarsal bone and base of proximal phalange, on a Klein balloon

The patient suffering from Parkinson's tends to lose his sensitivity and his foot mobility. Nevertheless the plantar sole is an important sensorial entry for the body balance.
One hand is grabbing the calcaneus, the other one is picking the metatarsal bones, with the patient being asked to bend his foot (Fig 24). A *triggering touch* is being carried out on the plantar sole, in longitudinal stretching, with hands moving apart from each other.



Fig. 24. Maneuver on the plantar sole

7. Late phase

When in the late phase of the illness, the NT maneuvers can still improve the patient's comfort, by easing the pain and improving the vertebral (spiral maneuvers) and thoracic mobility (thoracic amplitude and cardio respiratory capacity). Besides, the *normo-triggering touch* (which is antalgic) will allow the muscles to relax. (Figure 25)



Fig. 25. Gentle shaking of the legs in order to make the muscles relax, and to ease the blood circulation. Shaking of the lower then upper limbs

8. Conclusion

The Normotensive Therapy doesn't stand in the way of other traditional rehabilitative methods. It just adds its personal touch, its *triggering and relaxing touches*. The NT not only treats the symptoms but also the patient in his complexity, without forgetting the comorbidities. Dystonia and diskinesia, unpredictable, often very disturbing in rehabilitation, are attenuated and less frequent, thanks to the gentle and adaptable side of the NT, which can adjust if necessary, if the patient's health is changing, so that his confidence is restored without any added stress.

The central neurology patient is usually a little deprived of physical contact. Consequently his loss of body marks gets worse, and he is even more depressed. It is important to assess his postural problems regularly, by using well chosen therapeutic tools, in order to avoid being overwhelmed by difficulties. The therapist must be ready to adapt quickly. His finger must be at the right place, at the right moment, where and when it hurts. It must be a *vibrating finger,* a *relaxing finger,* a *gentle finger* and a *stroking finger*… A finger which "recognizes the needs of the body", a neuro-informational finger. That is the point of the Normotensive Therapy, which consists in stimulating the patient's balance, his walk and consequently his autonomy, by closely associating manual therapy and original exercises with an elastic bandage and also the Klein balloon during the same session.

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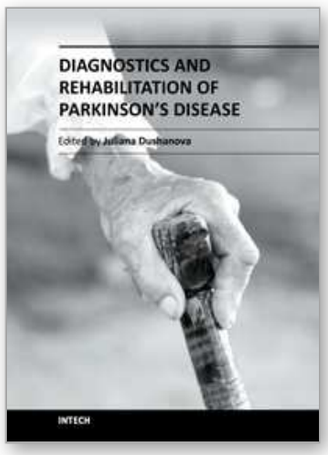
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Diagnostics and Rehabilitation of Parkinson's Disease presents the most current information pertaining to news-making topics relating to this disease, including etiology, early biomarkers for the diagnostics, novel methods to evaluate symptoms, research, multidisciplinary rehabilitation, new applications of brain imaging and invasive methods to the study of Parkinson's disease. Researchers have only recently begun to focus on the non-motor symptoms of Parkinson's disease, which are poorly recognized and inadequately treated by clinicians. The non-motor symptoms of Parkinson's disease have a significant impact on patient quality of life and mortality and include cognitive impairments, autonomic, gastrointestinal, and sensory symptoms. In-depth discussion of the use of imaging tools to study disease mechanisms is also provided, with emphasis on the abnormal network organization in parkinsonism. Deep brain stimulation management is a paradigm-shifting therapy for Parkinson's disease, essential tremor, and dystonia. In the recent years, new approaches of early diagnostics, training programmes and treatments have vastly improved the lives of people with Parkinson's disease, substantially reducing symptoms and significantly delaying disability. Written by leading scientists on movement and neurological disorders, this comprehensive book should appeal to a multidisciplinary audience and help people cope with medical, emotional, and practical challenges.

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