N.A.P. therapy for gait instability in neurorehabilitation

Case study of a patient with right hemiparesis and aphasia

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This case study describes the treatment of a chronically ill patient.
hemi patients in the N.A.P. therapy process.

1. Pathologies and leading symptoms

Mr. S. comes to the practice in December 2009 after his stroke on 16.11.2008 and 3 months of inpatient and 3 months of outpatient neurological rehab. Due to the occlusion of the internal carotid artery (ACI) on the left and the dissection, there is a right hemiparesis. Mr. S. is accompanied to therapy by relatives and can slowly climb the stairs with a cane in his left hand and walk to the therapy room. His gait is very unsteady and he is in danger of getting his right foot stuck and stumbling.

1.1 Primary deficit at activity and participation level

Because of the language problems, the therapist involves Mr. S.'s partner in the anamnesis discussion. By asking specific questions, she learns that Mr. S. would like to be able to go for walks with his dog and to be able to go to the doctor, the pharmacy, to therapy or to the shops without needing help or assistance. He would like to ride a bike or drive a car again.

Goals at participation level:

- walk the dog independently on a lead;
- to be able to travel to therapy, the doctor or everyday errands independently of an assistant, e.g. when the wife is working

Goals at activity level:

- Safe gait (without aids such as a walking stick) or reduce the risk of falling;
- More independent mobility, e.g. cycling or driving a car

1.2 Examination, hypotheses and parameters at the body structure and body function level

To form a hypothesis, a gait analysis was carried out on a flat stretch of road without aids (walking stick/rail) with video documentation. Together with Mr. S., the therapist watches the gait on video. Mr.
S. sways when walking in the frontal plane. The gait rhythm is uneven due to a shortened stance leg phase and stride length on the right.

At the end of the stance phase, terminal stance (TS), on the right, there is a lack of forefoot pronation and an external rotation of the talus. This is an indication of insufficient push-off of the plantar flexors, which in turn leads to reduced pre-stretching of the anterior tibialis muscle. This means that the full force for the subsequent swing leg phase cannot be applied. Mr. S. has to lift his pelvis to prevent his foot from getting stuck and to initiate the swing leg.

Based on these findings from the gait and video analysis, a first risk of falling is assumed. In order to be able to verify this using objective, reliable and valid measurement parameters, two motor test procedures are carried out:

1. Modified time-up-and-go test (MATHIAS et al. 1986; PODSIALO/RICHARDSON 1991): without orthotic splint 27 sec on 31.01.2012 (above 10 sec there is an increased risk of falling);
2. Functional reach test (functional reach according to DUNCAN) (DUNCAN et al. 1990): without orthotic splint 34 cm (normal value between the ages of 41 - 69 is 37.4 cm).

The results of these two tests confirm the hypothesis that the patient is at increased risk of falling and is therefore unable to walk safely or walk the dog on a lead.

The following hypotheses are conceivable at the body structure level:

- The fear of falling increases the sympathetic tone, leads to muscular co-activation and the joints become muscularly stiff.
- Due to the chronic disuse of the right extremities, the cortical representation changes and access to existing programs is not possible.
- Chronic disuse of the right extremities leads to increased tonic activity and phasic activity is reduced, resulting in a loss of elasticity and strength.

Mr. S. and the therapist work together to find out what conditions need to be created so that he is able to go to therapy or take his dog for a walk, for example:

- Safe walking with the dog on the lead (Fig. 1)
- good balance reactions if the dog suddenly pulls on the lead
- Reduced fear of falling

Fig. 1: Mr. S. walks his dog independently

2. Therapy goals and therapy planning

In order to be able to access old existing motor programs again, it is important to reduce the patient's fear of falling and, above all, of how they will get up on their own. Appropriate anxiety management can reduce the sympathetic tone and the resulting co-activation and muscular stiffening of the joints.

The objectives at a structural level are

- Improvement of cortical representation of the right extremities through successful use with orthosis;
- Promotion of elasticity of the dorsal structures of the UE (e.g. plantar-flexors, dorsal knee flexors and trunk extensors) to prevent contractures.

2.1 Therapeutic procedure

The following describes how the under 2. the goals defined in the Thera pie can be implemented through the application of N.A.P. techniques.

2.1.1 Cognitive fear management In order to take away Mr. S.'s fear of falling, protective steps and transitions from the ground to standing are practised with him in different starting situations and at different speeds. This randomized practice is intended to enable the practiced strategies to be recalled spontaneously for everyday life. Catching the body weight with the arms is practiced from a kneeling position.

Through the positive experience during the therapy process that Mr. S. does not necessarily have to hurt himself when falling if he quickly implements the practiced strategies and that he is able to stand up on his own, the fear of falling decreases and the sympathetic tone and thus the co-activation can be positively influenced.

2.1.2 Elasticity promotion of the plan- tarflexors

Promoting the elasticity of the planar flexors in the TS and improved push-off activity for the subsequent pre(PS) and initial swing (IS) can be achieved by practicing walking backwards on level ground and down the stairs. At the beginning, the therapist supports forefoot pronation at the Lisfranc joint line and the internal rotation of the talus (Fig. 2).

2.1.3 Promotion of push-off activity in the Stance terminal

In order to promote the push-off activity of the plantar flexors on the right in the TS and to support forward propulsion, a roller is used for practicing. The left leg is used as the supporting leg on

Fig. 2: Manual support of the right foothold in the terminal stance

Fig. 3: Mr. S. exercises the plantar flexor support activity on a roller

the roller and the right leg is positioned with the foot on the forefoot, as for push-off (Fig. 3). The therapist supports forefoot pronation and talus rotation and exerts a lengthening stimulus on the plantar tendon of the flexor hallucis longus muscle, while Mr. S pushes off with his right foot and rolls forward.

The scooter can also be used to practise protective steps in everyday life. To do this, the right leg is positioned in mid-stance (MS) on the roller. The left (healthy) leg is briefly placed on the scooter with the tips of the toes behind the right heel and then quickly lowered to the ground to stabilize the balance. Gripping the scooter with the right hand prevents contractures in the right hand. To grip the handle of the scooter, the therapist supports dorsal extension in the wrist by pushing the scaphoid volarly and pulling on the trapezium while opposing the thumb.

2.1.4 Promotion of hip extension in the Stance terminal

Hip extension in the TS, which is necessary for a reactive swing leg, is practiced on the stairs. The patient stands on their right leg and raises their left leg three steps. During this activity, the therapist supports hip extension in the right hip by pushing the tuberosity ventrally.

3. Course of treatment and results

Diagrams 1 and 2 show that the risk of falling has objectively decreased. Mr. S. was able to complete the time-up-and-go test significantly faster, especially with the orthotic splint.

As it is Mr. S.'s wish to be able to walk his dog and be mobile independently, it makes sense to test him in these activities. Walking the dog has become possible with a lead that Mr. S. ties around his torso, and he can now also ride a bike and drive a car again.

4. Conclusion

In this article, only an ex

of the entire N.A.P. therapy program.

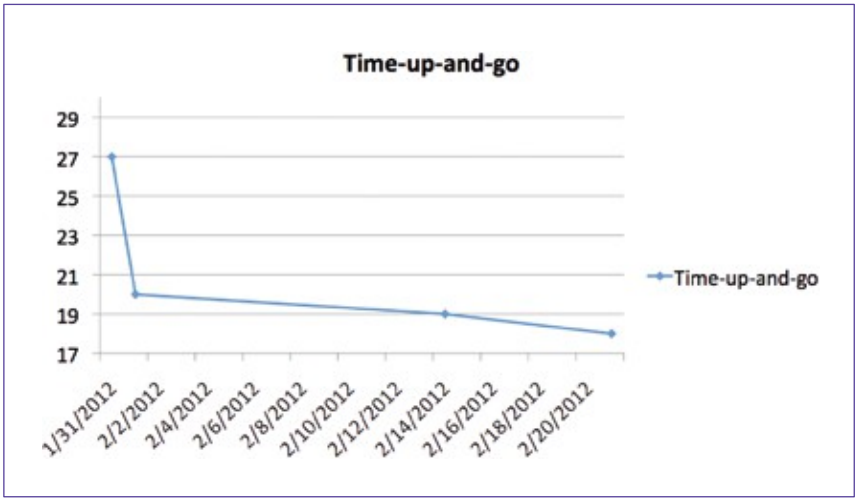

Diagram 1: Test and retest results of the modified time-up-and-go test measured in seconds

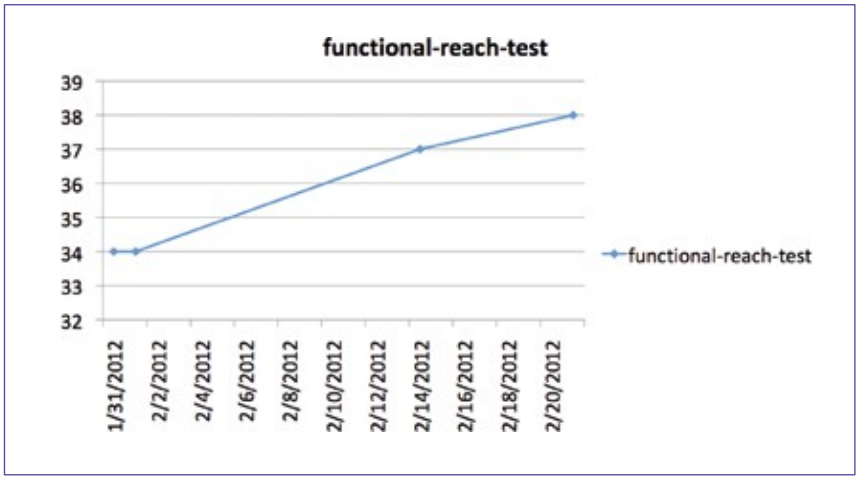

Diagram 2: Test and retest results of the functional reach test measured in cm

process. Long-term goals at the participation level for severely affected patients require more than three weeks of treatment.

Mr. S. is able to ride a bicycle again on a specially manufactured bike (Fig. 4). Mr. S. can also drive a car again. He had to take a special driving test for this. His car has been adapted for the disabled (Fig. 5, page XX).

However, it is not only these custom-made products that make it possible to achieve the goals, but also the structural adjustments made by the N.A.P. Therma

pie. Even the smallest adjustments to the

Fig. 4: Mr. S. on his bicycle

Fig. 5: Mr. S. gets into his car

Structures can be achieved in every therapy session if the structures are practiced variably in natural activities. Through randomized practice with changing environmental contexts and tempos, access to stored movement patterns is possible again in different situations. This is shown by the documentation of the modified time-up-and-go test, which was 7 seconds (without splint) and even 10 seconds (with splint) faster, especially in the first retest after only one therapy application.

The most commonly used N.A.P. principles in therapy are: cognitive pain and anxiety management, use of the po-

resources and the targeted design of the therapy situation. As a result, it is even possible to use predominantly hands-off techniques and still achieve these therapeutic successes.

The therapy results are largely due to Mr. S.'s enormous self-motivation. For the right motivation, it is important that realistic, measurable, accepted goals are chosen and that their achievement is set in terms of time. This makes success tangible. The goals at body structure and activity level were achieved in the N.A.P. therapy process shown here. Throughout the N.A.P. therapy process, new sub-goals were always agreed with the patient in order to motivate him.

This case study is intended to encourage other therapists to realize that treatment goals can always be achieved in the short term through creative therapy design, even with long-term, chronic patients, and that there is no need for a boring routine.

Mr. S's goal of being able to drive again was a particular personal motivation for him. Perhaps this case study can also give other patients the courage to realize that sometimes the seemingly "impossible" can become possible after all.

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