

CASE REPORTS

Functional effects of hydrokinesiotherapy and underwater shower in tetramelic sensorimotor demyelinating polyneuropathy rehabilitation – a case study

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Abstract

The troubles of peripheral neuropathy are often found in Rehabilitation Clinics, because this disease affects the functions of the locomotor system. The purpose of this study was to present a 41-year-old female patient from a rural area, diagnosed with Tetramelic Sensorimotor Demyelinating Polyneuropathy. She had followed a rehabilitation program in Colentina Clinical Hospital, Medical Rehabilitation Department, in August 2017, which included 3 sessions of hydrokinesiotherapy and underwater shower, one session with 1-2 days pause, in order to evaluate the clinical effects on the functional sensory and motor status. Thus, the intensity of burning sensations and headaches was measured with Visual Analog Scale, analytical articular and muscular testing was used, and data for body temperature, arterial pressure, pulse and blood glucose level, prior to and after each session were collected. The results show reducing of the intensity of the burning sensation and headaches, and various and inconstant muscular strength and global joint amplitude improvements.

Keywords: polyneuropathy, hydrokinesiotherapy, underwater shower, rehabilitation program, physical-kinetic therapy.

Introduction

Polyneuropathy is a neurological disease caused by damage to many peripheral nerves (nerves outside of the spinal cord and the brain), with a prevalence of 5-8% (Sommer et al., 2018) increasing with age (Hanewinkel et al., 2016). The troubles of peripheral neuropathy are often found in Neurological Rehabilitation Clinics and are among the most frequent neurological conditions with which physicians of all specialties are confronted (Watson & Dyck, 2015). Even if this disease may not directly affect mortality and longevity, it still affects the quality of life and activities of daily living (Hoffman et al., 2015). The most common causes are: diabetes, alcoholism, chemotherapy, genetic causes, vitamin deficiency or overdose, toxic, immunological processes (Sommer et al., 2018). It is considered in the literature that almost half of the cases are idiopathic (Hanewinkel et al., 2016). The symptoms also vary from patient to patient. Sensitive symptoms are gradual manifestations of subjective and objective sensitivity of the feet or hands which can spread upward, pain during activities that should not cause pain. Motor symptoms and signs are walking difficulties, lack of coordination and falling, troubles of fine motor skills, appearing from distal to proximal. When autonomic nerves are affected, heat intolerance can appear,

as well as excessive sweating or an inability to sweat, digestive problems, changes in blood pressure or in heart rate (1). Physiotherapy, exercises and ergotherapy can have benefits, depending on the symptomatology and functional deficits of the patient (Akyuz & Kenis, 2014; Sommer et al., 2018).

Hydrokinesiotherapy is a method that combines the physiological effect of hydrotherapy in external care with kinesiotherapy which, in this way, is facilitated by the hydrostatic force. The warm bath at 35-36 °C induces peripheral vasodilatation while reducing blood pressure, increasing heart rate and cardiac labor, and also reducing muscle tone and peripheral sensitivity with modified pain perception. It has a psychological effect of physical comfort and trust, which can be explained by the facilitation of body segment movements (Honda & Kamioka, 2012; Hżeczka, 2019). Underwater shower is a form of whirlpool using a tangential and inclined water jet on the treated surface, at a distance from the patient so as not to determine unpleasant sensations. The temperature of the water can be between 30 and 38 °C and the pressure can range between 2 and 4 Kg/cm². It is well tolerated, and its therapeutic effects are analgic, muscle relaxation (Dumitraşcu et al., 2012; Mooventhan & Nivethitha, 2014).

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Case study

The presentation of this case study, of images and data is made with the patient's informed consent. We are hereby presenting the case of a 41-year-old woman, with a height of 160 cm, a weight of 70 kg, from a rural area, a housewife, non-smoker, with occasional alcohol abuse - withdrawn 3 years before, known to suffer from demyelinating sensorimotor polyneuropathy, diagnosed in 2014 but with symptomatology reported 10 years before, which progressively aggravated (right>left). The diagnosis was confirmed in 2017 after histopathological examination by right sural nerve and gastrocnemius muscle biopsy. The subject was hospitalized in the Colentina Clinical Hospital, Medical Rehabilitation Department, between 21st and - 31st of August, 2017. It is also worth mentioning the stressful physical everyday work she was exposed to (agricultural and housework). Secondary diagnoses were: obesity, ocular toxoplasmosis with left eye prosthesis since 2004; depressive anxious disorder; multiple drug allergy to pollen, dust and mold; left clubfoot – surgery in childhood with elongation of the Achilles tendon; intermittent cephalalgia improved with Cymbalta.

Assessment

At the time of admission, the subject presented frontal-parietal-occipital headaches - measured on the Visual Analog Scale (VAS) by 7/10, significant burning sensation in the lower extremities - measured on VAS by 8/10, without deep or superficial sensitivity disorder, numbness in the upper limbs, globally diminished response of osteotendinous reflexes, without muscular atrophy; she was euphraxic, conscious.

Data collected following functional articular and muscular evaluation

Generalized joint stiffness; slight motor deficit on different levels, more expressed in the right radiocarpal joint; ulnar deviation of the right hand by 30° and limited wrist extension by 50°; bilateral clubfeet, inversion - eversion of the foot not possible; in the right knee, anteroposterior hyperlaxity (hyperextension) and hypermobile patella; left genu valgus; walks without help, slightly balanced walk. Paraclinical exams disclose normal biological values.

Treatment

With the patient's informed consent, a specific, complex rehabilitation program was initiated. This program included hygienic-dietary indications, medication, hydrokinesiotherapy in butterfly bath and underwater shower in 3 sessions, one session followed by 1-2 days pause, associated for 10 days with a daily physical-kinetic program adapted to the case. Physical treatment included galvanization of the lower limbs, ultrasounds in the paravertebral cervical and lumbar spine, laser in the radiocarpal joint, magnetic therapy of the lower limbs. The kinetic program included active and active with resistance exercises for muscle strength, walking, coordination and balance exercises, pelvic floor strengthening exercises (***, 2019).

To better assess evolution, the subject was tested prior to and after each session of hydrokinesiotherapy and underwater shower, and all the values were then collected.

For muscle testing, the Manual Muscle Testing Procedures were used (Clarkson, 2012); (2) and Range of Motion (ROM) was measured with a goniometer. We also collected data for body temperature, arterial pressure, pulse and blood glucose level to assess patient tolerance to the treatment. Subjective symptoms (burning sensation in the limbs and numbness, and also headaches) were evaluated before and after each session with VAS.

To study the effects of hydrokinesiotherapy and underwater shower we proposed the next goals:

- diminishing pain (burning sensation) and also headaches;
- poor posture, stiffness and musculotendinous retraction prevention and improvement for the extremities;
- mobility increase in the affected joints and muscle strengthening;
- stimulation of peripheral proprioception because hydrostatic pressure is favorable to a better perception of the limb positions under the stimulus produced in water.

The subject was immersed in water at a temperature of 36.5°C, in the butterfly tub, for 5 minute relaxation and after that, she underwent treatment consisting of passive mobilization of all the joints, especially the ankle-foot complex and the radiocarpal joint (to maintain the trophicity of cartilage, joint flexibility and to prevent poor posture), followed by global muscle strengthening exercises (Fig. 1).



Fig. 1 – Global muscle strengthening exercises.

The sessions consisted of global and analytical exercises using or against water resistance, followed by underwater shower with water at a pressure of 5 atmospheres and a temperature of 36.5°C. The total duration of the procedure was 45 minutes - 1 hour (25-30 minutes underwater shower – for the upper and lower limbs). The performed exercises were sets of 10 repetitions of ROM movements for the upper and lower limb (Fig. 2).

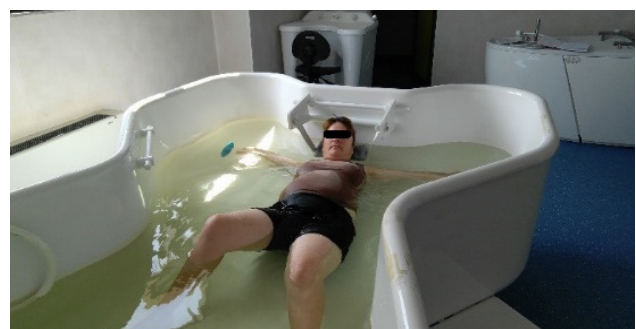


Fig. 2 – ROM movements for the upper and lower limb.

Results and discussions

The results are collected in the individual Testing Chart

for each session of hydrokinesiotherapy and underwater shower presented in Tables I, II, and III.

Table I
Testing Chart - First Session.

UPPER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
SHOULDER	Before	After	Before	After	Before	After	Before	After
Flexion	150	150	150	160	4+	4+	4+	4+
Extension	65	65	65	65	4+	4+	4+	4+
Abduction	140	140	140	140	4+	4+	4+	4+
Internal rotation	80	90	70	90	4+	4+	4	4
External rotation	90	90	90	90	4-	4-	4-	4-
ELBOW								
Flexion	70	120	80	120	4+	4+	4+	4+
Extension	70	70	80	120	4-	4-4-	4+	4+
Ulnar inclination	55	80	30	55	4-	4+	4+	4+
Radial inclination	90	90	70	75	4+		4+	4+
RADIOCARPAL JOINT								
Flexion	52	52	70	70	4-	4-	4-	4-
Extension	50	60	50	50	4-	4-	4-	4-
Ulnar inclination	38	38	30 dev.	30 dev.	4-	4-	4-	4-
Radial inclination	40	40	0	0	4-	4-	1	1
LOWER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
HIP	Before	After	Before	After	Before	After	Before	After
Flexion	75	80	80	85	4+	4+	4-	4-
Extension	18	20	20	20	4+	4+	4	4
Abduction	50	50	40	45	4-	4-	4+	4+
Internal rotation	35	40	40	40	4+	4+	4	4
External rotation	15	18	30	30	4-	4-	4-	4-
KNEE								
Flexion	75	90	90	90	4-	4-	4-	4-
Extension	70	80	80	85	4	4	4+	4+
ANKLE								
Plantar flexion	20	20	20	25	4+	4+	4	4
Dorsiflexion	10	10	15	18	3+	3+	4-	4-
Inversion	0	0	0	0	0	0	0	0
Eversion	0	0	0	0	1	1	1	1
CLINICAL PARAMETERS								
	Before		After		After 1H			
Blood pressure	120/60 mm Hg		100/70		130/70			
Heart rate	84		84		78			
Temperature °C	35.8 °C		37.2 °C		37.0 °C			
Blood Glucose Level	140 mm/dl		143mg/dl		-			

Table II
Testing Chart - Second Session.

UPPER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
SHOULDER	Before	After	Before	After	Before	After	Before	After
Flexion	150	150	160	465	5	5	5	5
Extension	65	65	65	65	5	5	5	5
Abduction	140	140	140	140	5	5	4+	4+
Internal rotation	90	90	90	90	4+	4+	4	4
External rotation	90	90	90	90	4-	4-	4-	4-
ELBOW								
Flexion	120	140	120	120	4+	4+	4+	4+
Extension	120	140	120	120	4	4	4+	4+
Ulnar inclination	90	90	70	75	4+	4+	4	4
Radial inclination	80	90	70	75	4+	4+	4+	4+
RADIOCARPAL JOINT								
Flexion	52	52	70	70	4-	4-	4-	4-
Extension	60	50	50	50	4-	4-	4-	4-
Ulnar inclination	28	38	30 dev.	25 dev.	4+	4+	4-	4-
Radial inclination	25	35	10	18	4+	4+	3+	3+
LOWER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
HIP	Before	After	Before	After	Before	After	Before	After
Flexion	80	85	85	85	4+	4+	4+	4+
Extension	20	20	20	20	4+	4+	4	4
Abduction	50	50	45	45	4	4	4+	4+
Internal rotation	35	40	40	40	4+	4+	4	4
External rotation	20	30	30	30	4	4	4+	4+
KNEE								
Flexion	90	90	95	95	4-	4	4+	4+
Extension	75	80	90	90	4+	4	4+	4+
ANKLE								
Plantar flexion	20	20	20	25	4+	4+	4	4
Dorsiflexion	10	10	10	15	3+	3+	4-	4-
Inversion	0	0	0	0	0	0	0	0
Eversion	0	5	0	0	1	3	1	1
CLINICAL PARAMETERS								
	Before		After		After 1H			
Blood pressure	130/80 mm Hg		120/60 mm Hg		100/70 mm Hg			
Heart rate	84		84		78			
Temperature °C	36.8 °C		37.2 °C		37 °C			
Blood Glucose Level	140 mg/dl		143 mg/dl		-			

Table III
Testing Chart - Third Session.

UPPER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
SHOULDER	Before	After	Before	After	Before	After	Before	After
Flexion	150	155	170	170	5	5	5	5
Extension	68	75	68	75	5	5	5	5
Abduction	160	165	150	170	5	5	5	5
Internal rotation	90	90	90	90	4+	5	4	4+
External rotation	100	105	100	100	4+	4+	4+	4+
ELBOW								
Flexion	140	140	130	130	4+	5	4+	4+
Extension	140	140	140	140	4	4	4+	4+
Ulnar inclination	90	90	80	70	4+	4+	4+	4
Radial inclination	90	90	90	90	4+	4+	4+	4+
RADIOCARPAL JOINT								
Flexion	52	52	70	70	4-	4-	4-	4-
Extension	50	50	50	50	4-	4-	4-	4-
Ulnar inclination	40	40	20 dev.	20 dev.	4+	4+	4-	4-
Radial inclination	25	20	20	20	4+	1+	3+	3+
LOWER LIMB								
Region/ movement	Joint testing				Muscle testing			
	Left		Right		Left		Right	
HIP	Before	After	Before	After	Before	After	Before	After
Flexion	80	85	90	90	5	5	4+	5
Extension	30	30	30	30	4+	4+	4+	5
Abduction	50	50	50	50	5	5	4+	5
Internal rotation	35	40	40	40	4+	4+	4	4
External rotation	30	30	30	40	4	4+	4+	4+
KNEE								
Flexion	92	105	110	110	4-	4	4+	4+
Extension	80	70	70	85	4+	4+	4-	4-
ANKLE								
Plantar flexion	20	20	20	25	4+	4+	4	4
Dorsiflexion	10	18	15	30	4-	4+	4+	4+
Inversion	0	0	0	0	0	0	0	0
Eversion	0	0	5	5	1	1	3	3
CLINICAL PARAMETERS								
	Before		After		After 1H			
Blood pressure	140/80 mm Hg		130/90 mm Hg		140/80 mm Hg			
Heart rate	88		90		90			
Temperature °C	36.8 °C		36.8 °C		35.8 °C			
Blood Glucose Level	119 mg/dl		130 mg/dl		-			

There are data in the literature that present a relative effectiveness of hydrotherapy in the treatment of polyneuropathies (Barker et al., 2014; Heywood et al., 2017; Zivi et al., 2018); therefore, our study has a close-up view over each session of hydrotherapy to analyze the clinical effects and the role of this kind of therapy in the context in which our patient followed other types of physio-kinesiotherapies as well. The results show various and inconstant muscular strength and global joint amplitude improvements as follows:

In the shoulder, for flexion, on the right side, mobility increased from 160 to 170 after the third session. Muscle strength increased from 4 to 5 on both sides as early as the second session. For extension, at the third session, values

increased by 10 degrees on both sides compared to the first session. For abduction, an increase in values for ROM and for muscle strength was obtained, but for internal rotation, the same passive mobility and the same muscular strength were obtained. For external rotation, an increase in mobility was obtained at the third session (before and after) and muscle strength increased from 4- at the first session to 4+ at the third session. In the elbow, there was an important increase in values for flexion on both sides, from 70 to 140 degrees on the left side (the testing before the first session compared to the testing after the third session). For extension, an important increase in values was obtained from 80 to 120 degrees even from the first session on the right side and at the second session the increase was even higher, to 140 degrees. For pronation, there was an increase in mobility on the right side, but values were the same for muscle strength. For the radiocarpal joint, ROM and muscle strength were the same until after the third session. For ulnar deviations on the right side, a reduction of the measured values from 30 to 20 degrees was obtained, and ulnar inclination was reduced from 40 to 28 degrees after the last session. For muscle strength, the value for the left side increased from 4- to 4+ even from the second session, and that value was maintained at the third session. Radial inclination was improved on the right side by reducing the cubital deviation for ROM (from 0 to 20) and for muscle strength (from 1 to 3+).

For the lower limb, hip mobility and muscle strength for flexion and extension were improved on both sides. Regarding abduction, the same values were obtained on both sides with no improvement, with one exception: an improvement of 5 degrees at the third session on the right side; muscle strength had a significant improvement from 4- to 5 on the left side after the third session. Internal rotation had no improvement at all, the values were the same for ROM and muscle strength. External rotation was improved by 15 degrees on the left side and by 10 degrees on the right side, but only at the end of the third session. For muscle strength, an improvement from 4- to 4+ for both sides was obtained. For the knee, flexion was improved on both sides by 20 degrees, and muscle strength was improved especially on the right side. For the ankle, the mobility of left plantar flexion was unchanged and for the right side there was a little improvement of 5 degrees after the bath from the second and third session; muscle strength was not improved. Dorsiflexion showed low values of improvement after each bath, but with recurrence before the next session for ROM. For muscle strength, an improvement was obtained after the last session. For inversion, no different results were obtained because this movement is completely impossible for both sides in association with clubfoot from childhood. For eversion, there was a 5 degree improvement on the left side after the second session, with recurrence before the next session, and on the right side 5 degrees were obtained until the final examination, and also an increase in muscle strength to up to 3.

Clinical parameters indicate a reduction of blood pressure after each session with reversion after 1 hour, in correlation with the literature, and no difference for heart rate, negatively correlated with the literature (Vizitiu &

Benedek, 2018), a slight increase of the body temperature only after the first and second session and a small enhancement of the blood glucose level (3 mg/dl for the first and second session and 13 mg/dl for the third session) indicating a good tolerance of the procedure.

The burning sensation in the lower limbs was reduced from 8 to 4 on VAS, and numbness also decreased even after the first session and was maintained until after the third session. Also, the intensity of headaches was reduced from 7 to 4-VAS, evaluated after the third session, which is in agreement with the literature data (Sujan et al., 2016).

It is interesting to notice that after the treatment course that the patient followed in August 2017, she asked at the next hospitalizations, in 2018 and 2019, the same kind of physical treatment, especially hydrokinesiotherapy and underwater shower, which proves the impact and the role of these physical therapies in patient's perception of the rehabilitation program.

Particularities of the case

- the inability to diagnose earlier; the subject complained of typical pain for many years prior to assessment (10 years);
- the association of bilateral clubfeet complicates functional status;
- physical labor and symptom neglect;
- significant visceral adipose tissue accumulation causing an imbalance in the pelvic area.

Prognosis

- ad vitam: good, if the patient has a balanced lifestyle, follows the treatment scheme, loses weight and exercises every day;
- ad functionam: favorable, but depending on the neural damage yet to come;
- ad laborum: satisfying, if she avoids fatigue, cold exposure and static postures.

Conclusions

1. Early onset of pain reduction (burning sensation and numbness).
2. Reducing the intensity of headaches.
3. Various and inconstant muscle strength and global joint amplitude improvements that need further research.
4. The treatment has good tolerance and a high psychological impact on the subject.

Conflict of interest

No conflict of interests.

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