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Case Report

Influence of proprioceptive neuromuscular facilitation on the muscle tonus and amplitude of movement in HTLV-1-infected patients with HAM/TSP

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Abstract

An HTLV-1-infected patient can develop paraparesis that limits their movements. Rehabilitation techniques could improve the motor abilities of these patients. The present study investigates five cases of physical therapy intervention in HTLV-1 patients to evaluate the influence of functional rehabilitation on the tonus and range of motion (ROM) of HTLV-1 patients with spasticity. The patients had a gain of ROM, especially in the lower limb, and reduction in hypertonia/spasticity after functional treatment. The reduction in hypertonia increased the ROM. Thus, functional methods may be valuable for the rehabilitation of HTLV-1 patients with neurological damage.

Keywords: HAM/TSP. Proprioceptive neuromuscular facilitation. Physiotherapy.

INTRODUCTION

Approximately 20 million people worldwide are infected with the type-1 human T-cell lymphotropic virus[1,2]. Approximately 90-95% of individuals infected with HTLV-1 remain asymptomatic, and only 5% experience signs and symptoms associated neurological complex associated with HTLV-1. This complex is called HTLV-1-associated myelopathy/tropical spastic paraparesis (HAM/TSP), which is characterized by chronic progressive demyelination[3], weakness in the lower limbs, spasticity and/or global hyperreflexia, with the possibility of sphincter dysfunction, sexual impotence, intestinal constipation, and alteration of tactile sensitivity[1,3,4]. The evolution of the disease features motor involvement, gait alteration, impairing dynamic balance, and restricting gait independence to the use of walkers, crutches, and wheelchairs[1,4]. Due to the high morbidity of the HTLV-1-associated manifestations, it is necessary to create alternatives for motor rehabilitation of the patients with disabilities[3,4]. Therefore, targeted treatment with physiotherapeutic strategies, that aim for functional rehabilitation using adequate techniques to avoid the limitation of the muscle tonus and amplitude of movement[4], is crucial for HAM/TSP patients.

One kinesiotherapeutic technique that could be applied in HAM/TSP patients is the proprioceptive neuromuscular facilitation (PNF)[5]. During stretching through the PNF technique, active muscle contractions are used to provide an autogenic inhibition of the elongated muscle. There is a reflex muscle relaxation that, in association with passive stretching, promises gain in the range of motion (ROM)[6,7]. In a previously reported case-control study, they compared the effects of the PNF treatment. They observed that both self-administered and therapist-administered PNF protocols were effective in the treatment of HTLV-1 patients[8].

The present investigation reports five cases of HAM/TSP patients with spasticity and their outcomes in the muscle tonus, ROM, and quality of life. We extended the previous findings of PNF as an important therapy to increase the functionality of the patient, as well as their quality of life[8].

CASE REPORT

Subjects

The present investigation was approved by the ethics committee for research in humans of the Tropical Medicine Nucleus, Federal University of Pará (report n°09/2009). All subjects provided written consent to participate in the study. This case report comprises a sample size of five with HAM/

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TSP (three males, two females, aged between 40-49 years). One patient was a full-time wheelchair user, another walked with orthosis for 2m, and three could freely walk, but with the assistance of orthoses. No patient had any neurological manifestations not associated with the HTLV-1 infection, loss of cognition, or speech disturbance.

Proprioceptive neuromuscular facilitation program

One physiotherapist from the International PNF Association applied the treatment. The procedures were divided into painful phase, preparatory phase for gait, and walking phase. The painful phase occurred only for the patients who started the sessions complaining of pain. For this phase, techniques were applied such as muscle relaxation of the lower limbs and paravertebral regions, transcutaneous electrical nerve stimulation therapy for 30 min, passive stretching of the posterior muscles and the adductors of the thigh, and pelvis dissociation in diagonal movements with anterior elevation and posterior depression.

In the preparatory phase for gait, techniques were used for active stretching of contraction-relaxation of the lower limbs; passive mobilization of the pelvis with diagonal movements of anterior elevation and posterior depression; training of rolling in anterior elevation of pelvis and anterior depression of the scapula; bridging exercises; chopping (upper trunk flexion pattern) and lifting (upper trunk extension pattern); combination of isotonic contractions; diagonal trunk flexion combined with trunk extension; diagonal movements for lower limbs flexion, adduction, and outer hip rotation with flexion of the knee and dorsiflexion of the ankle; and hockiling (reversal of stabilizations for lower trunk). In the gait phase, we used techniques of pelvic antero-elevation in the lateral decubitus position and return to flexion diagonal with adduction and external rotation of upper limb; half-sitting (pelvic anterior elevation for weight loss of the contralateral lower limb); standing in parallel bars with gait training for initial contact; load response; terminal support middle support; initial and medium balance; and end support.

Evaluation of the amplitude of movement and muscle tonus

All patients underwent a functional physiotherapeutic evaluation with verification of ROM by goniometry and evaluation of tonus and spasticity by the modified Ashworth scale. The evaluation results were classified as normotonic (NT); light hypertonic (LH); moderate hypertonic (MH); and severe hypertonic (SH). These methods were used before and after the physiotherapeutic treatment.

Functional evaluation

We used the Barthel index to measure the functional independence of the patients and the needs for assistance in mobility and self-care which was composed of 11 items[9]. The questionnaire was self-evaluated before and after the therapy, using scores between 1 (totally disabled) and 5 (totally enabled). The patients' functionality was classified as: total dependence (scored between 0-20); severe dependence (scored between 21-60), moderate dependence (scored between 61-90); and slight dependence (scored between 91-99).

Assessment of quality of life

We used the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) to investigate the quality of life of the patients[10]. We chose eight items to question the patients (functional capacity, functional limitation, pain, general health, vitality, social aspects, emotional aspects, and mental health) and we compared them before and after of the therapy. The score of SF-36 ranged between 0 (the worst quality of life) and 100 (the best quality of life). We evaluated the score of each patient as worst (between 0 and 29); worse (between 30 and 49); moderate (between 50 and 69); good (between 70 and 89); and optimal (between 90 and 100).

Data analysis

The data analysis was assessed, both quantitative and descriptive, through the BioEstat version 5.0.

RESULTS

On physical examination, the analysis of muscle tonus was directed to specific muscle groups on both sides of the body (**Table 1**). The adductors and abductors of the hip had no change in the muscle tonus after therapy. The muscles which presented the highest muscle tonus variation after the treatment were the hip extensors and the bilateral triceps surae.

The evaluation of ROM through goniometry before and after therapy is shown in **Table 2**. All muscles analyzed showed increased ROM, with global movement gain. The hip flexors, the knee flexors, and the dorsiflexors were the muscles with the greatest gains in the ROM. The bilateral plantar flexors and the abductors and adductors of the hip showed a more distinct change in ROM after therapy.

The functionality evaluation showed that before the treatment we had two severely dependent patients, two moderately dependent patients and one totally independent patient. Four out of five patients had an increase in the Barthel index and one patient had a decrease in this index after the therapy. The change in the index was enough to change the level of dependence for four out of five patients. Two patients changed from moderate dependence to slight dependence, one patient changed from severe dependence to slight dependence, and 1 patient changed from total dependence to slight dependence. One Patient remained severely dependent even after the therapy.

In the evaluation of the quality of life, we observed that the patients tended to perceive a better quality of life. **Figure 1** shows the score of the SF-36. The items of the functional capacity, functional limitation, and emotional aspects changed to higher scores, while the general health had lower variation after the therapy.

DISCUSSION

We observed a reduction of muscle tonus in specific muscle groups, and it could even reach tonus normalization in some patients, besides the gain of ROM. We replicated the results showed in the case-control study[8] with a description of functional improvement. Comparing the studies, we verified the present study deals with a case study using instruments

TABLE 1: Evaluation of muscle tonus of the two halves of the body before and after therapy.

		Before	After
Muscle groups	**Tonus**	**Number of subjects (R/L)**	**Number of subjects (R/L)**
Pelvic extension			
	NT	1/1	4/4
	LH	1/1	0/0
	SH	3/3	1/1
Knee extension			
	NT	2/2	3/3
	LH	0/0	0/1
	SH	3/3	2/1
Abductors of the hip			
	NT	5/5	5/5
	LH	0/0	0/0
	SH	0/0	0/0
Hip adductors			
	NT	3/3	3/3
	LH	2/2	1/1
	SH	0/0	1/1
Triceps surae			
	NT	0	3/3
	LH	2	1/1
	SH	3	1/1

R: half-body right; **L**: half-body left; **NT:** Normotonic; **LH:** Light hypertonic**; MH:** moderate hypertonic **SH:** severe hypertonic.

TABLE 2: Range of motion performed in the limbs of the left and right half-body.

Range of motion at the half-body right (grade)																		
Patient	**Hip extension**			**Knee extension**			**Abductors hip**			**Adductors hip**			**Dorsiflexors**			**Plantar flexors**		
	B	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**
P1	12	45	33	60	80	20	22	30	8	13	30	17	0	15	15	4	10	6
P2	20	26	6	44	110	66	26	30	4	10	16	6	10	26	16	10	16	6
P3	80.6	128	47.4	106	114	8	26.6	40	13.4	12	32	20	22.6	95	72.4	9.3	20	10.7
P4	63	69	6	132	138	6	8	21	13	12	20	8	19	84	65	12	14	2
P5	15	20	5	21	30	9	8	8	0	5	10	5	5	10	5	2	10	8
Range of motion at the half-body left (grade)																		
Patient	**Hip extension**			**Knee extension**			**Abductors hip**			**Adductors hip**			**Dorsiflexors**			**Plantar flexors**		
	B	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**	**B**	**A**	**V**
P1	22	80	58	60	80	20	30	35	5	12	25	13	8	20	12	4	15	11
P2	19	80	61	49	113	64	30	30	0	4	16	12	4	22	18	5	16	11
P3	53.3	140	86.7	82.6	130	47.4	26.3	34	7.7	10	28	18	19.3	90	70.7	7.3	30	22.7
P4	67	79	12	132	138	6	10	28	18	16	18	4	19	20	1	17	19	2
P5	20	28	8	38	44	6	12	16	4	5	8	3	16	18	2	3	8	5

B: before; **A:** after; **V**: variation.

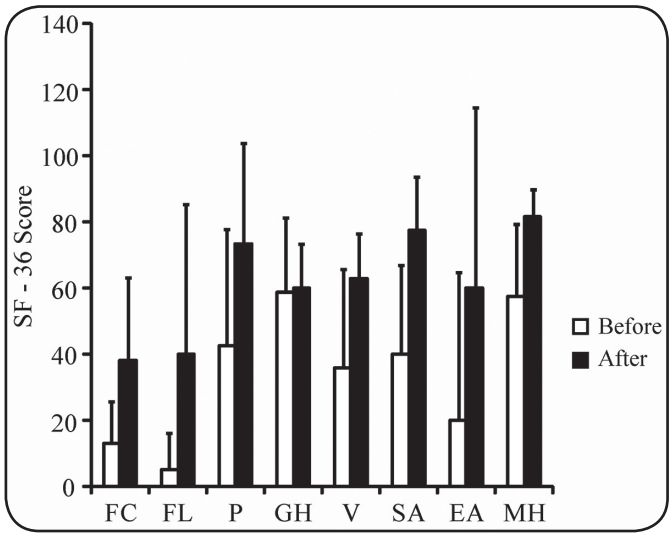

FIGURE 1: A comparison of the mean scores obtained for eight SF-36 domains before (white bars) and after (dark bars) the PNF therapy. For all domains, we observed an increase in the mean score after therapy. The domains with higher increase were functional capacity, functional limitation, and emotional aspects, while general health had lower variation after the therapy. **SF-36:** Medical Outcomes Study 36; **PNF**: proprioceptive neuromuscular facilitation; **FC:** functional capacity; **FL**: functional limitation; **P:** pain; **GH:** general health; **V:** vitality; **SA:** social aspects; **EA**: emotional aspects; **MH:** mental health. Error bars represent the standard deviation of the mean.

such as the Barthel scale; goniometry; the Modified Ashworth scale and SF-36 scale. While the other study[8] is a case control; using Functional Independence Measure (FIM) scale; the Modified Ashworth scale; Timed Up and Go scale. Both studies evaluated the functionality of the HTLV-1 patients after the PNF therapy and its impact on their daily life. Even considering the differences in the methods of PNF application (number of sessions, intersession period, duration of treatment) between our investigation and the previous one, it was possible to obtain improvement in the overall status of the patients in both studies, confirming that PNF is a powerful therapeutic technique that can be applied on the motor function loss caused by HTLV infection.

The results must be explained by the reduction of spasticity, which causes a decrease in the resistive factor of passive joint movement and a gain in ROM. In performing the stretching contraction-relaxation, the PNF method used active muscle contractions with the intention of providing an autogenic inhibition of the antagonist muscle, releasing the possible resistances for the passive movement of the joint[5-7,11]. Thereby, the elongation is used to promote the increase of musculotendinous and periarticular connective tissue extensibility, favoring the increase of joint flexibility, as well as promoting the increase of ROM[12].

We concluded that the insertion of the physiotherapeutic protocol for HTLV-1 carriers with neurological manifestations, reduced spasticity, and increased ROM, maximizing the performance of activities of daily living and decreasing the restriction to walk.

Conflict of interest

The authors declare that there is no conflict of interest.

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