POSTURAL PROFILE OF INDIVIDUALS WITH HAM/TSP

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Abstract
Objectives: The aim of this survey was to delineate the profile of patients with HTLV-1 associated with HAM/TSP by comparing them with a group of healthy subjects. **Methods:** This was cross-sectional study conducted at the HTLV Center of "Escola Bahiana de Medicina e Saúde Pública,Bahia",Brazil, 30 volunteers with HAM / TSP were paired with 30 healthy subjects, who underwent a postural evaluation by means of a Postural Assessment Software (SAPO®). **Results:** A trend characterized by postural projection of the trunk forward or backward, forward displacement of the body, bending the knees and

ankle angle reduction was noted. **Conclusion:** This study demonstrates that there is a posture typical of the HAM/TSP patient which manifests itself with changes in the sagittal plane.

Keywords: HTLV-1; Tropical Spastic Paraparesis; Posture; Rating.

INTRODUCTION

The human T-cell lymphotropic virus (HTLV-1) is endemic in many regions of the world.[1] HTLV-1 also has high incidence and prevalence in Brazil,especially in the city of Salvador(prevalence of 1.76).[2] The HTLV-1 is associated with a myelopathy known as tropical spastic paraparesis (HAM/TSP). It is characterized by a demyelinating, slowly progressive disease,associated with weakness of lower limbs,sphincteric dysfunction,and sensitivity impairment.[3] Patients with HAM/TSP present biomechanical, sensitive, and functional alterations.In addition to hypertonia, the clinical condition comprises pelvic girdle and lower limb paresis. This weakness, along with spasticity,muscle shortening and joint hypomobility, probably causes an abnormal.[4]

Studies have described the postural profile in populations with specific clinical diagnosis,because these data can help functional assessment and planning of a comprehensive therapeutic program.[5] A computerized postural assessment may help to systematize the clinical practice of physical therapy in the treatment of patients with HAM/TSP, both the functional and biomechanical diagnosis,and to monitor the results of specific interventions. Considering the lack of an objective assessment of the posture of individuals with HAM/TSP, this study sought to delineate the postural profile of these individuals by comparing them with a group of healthy subjects.

MATERIALS AND METHODS

This was cross-sectional research conducted at the HTLV Center of Escola Bahiana de Medicina e Saúde Pública (Bahiana School of Medicine and Public Health), Bahia, Brazil. The sampling was of convenience, the population consisted of a group of healthy people and another formed by patients with HAM/TSP. Data was collected from April to November 2008. Subjects who agreed to signing the informed consent, were diagnosed with HTLV-1 by ELISA and confirmed by Western Blot Test, and manifested clinical signs compatible with HAM/TSP were consecutively included in the study. Patients suffering from other disorders that compromised the definition of postural profile, such as rheumatic and orthopedic diseases, other neurological disorders, patients unable to remain in orthostasis without assistance and those who had cognitive impairment that could compromise the postural assessment, as well as those who were undergoing physiotherapy were excluded from the study.

The comparative group was comprised of employees of "Bahiana School of Medicine and Public Health who agreed to participate in the study. It was selected based on characteristics similar to those of patients with HAM/TSP, with regard to age-range, Body Mass Index (BMI), gender and color. The two groups were subjected to postural assessment using the form indicated by the free software for computerized assessment of posture-SAPO.[6] The aim of adding a comparison group was to compare the measurements with those of the group of individuals with HAM/TSP.

The study was approved by the Ethics Committee of Bahiana School of Medicine and Public Health, Protocol No.84/2007. The sample calculation of a pilot study identified the the ankle angle as a measure that showed a statistically significant difference between the groups of patients with HAM/TSP and healthy people; it required 30 patients in the HAM/TSP and 30 volunteers in the comparison group,with a difference between the mean ankle angle of 5.49 degrees, a confidence interval of 95% and alpha of 0.05.[7]

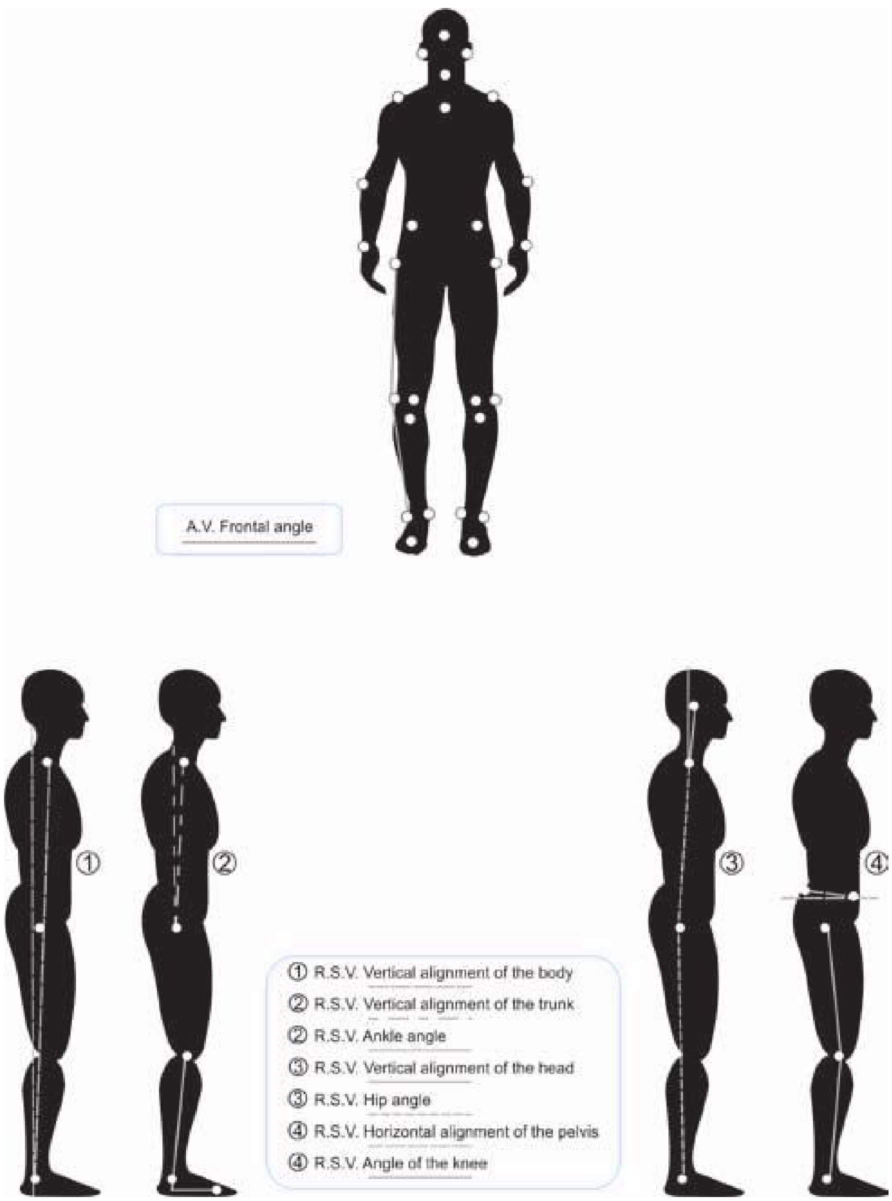
Height and weight were measured using a properly calibrated mechanical anthropometric scale, Welmy brand (Santa Barbara D'Oeste, USA), and BMI was calculated. Selected subjects underwent an orthostatic postural evaluation by means of two-dimensional image using a digital camera,with resolution of 3.2 megapixels (Olympus Imaging Corporation D-535, China), fixed on a tripod, perpendicular to the individual, at a distance three meters away from the individual and at a height equal to half of the individual's height. Plot points for postural assessment were preselected by the protocol of the Postural Assessment Software, SAPO® version 0.67 (USP, São Paulo, Brazil). To highlight these anatomical points, isopor hemi-spheres (25mm) were used. For image calibration, a plumb line was used, attached to the ceiling, with two isopor balls with distance of 30 centímetros between them, parallel to the midline of the body of the individual being assessed.[8]

A photographic record of the entire body was made of the patient, in a position that he/she considered comfortable, in the usual four views: anterior and right and left sides.In order to maintain the parameters, after taking up the first comfortable position, the contour of the patient's feet was outlined using chalk on a black rubber mat. This served as a reference to maintain the same rotation of the feet in the three anatomical views. Study volunteers were instructed to remain barefoot, female patients used shorts and bra, and male patients only shorts. Photographs were taken during a short apnea after an inspiration. The elbows were flexed to 90 degrees, feet slightly abducted, and Frankfurt plane parallel to the ground. The procedure was performed after an interval of five seconds, once the individual had been properly positioned.[8]

Pictures were transferred to the computer and calibrated in the actual vertical and longitudinal measures. Through the selected plots,joint angles were analyzed. As the study sample consisted of patients with paraparesis,there were selected measures focused on possible postural deviations in the lower limbs,not excluding the possibility of interference of these deviations in the other body segments (Figure1): 1) the angle formed by greater trochanter, the knee joint line and lateral malleolus, which is called the frontal angle, with possible tendency to valgus knee and varus knee; 2) angle between the tragus-acromion and the vertical axis, which checks the vertical alignment of the head and a tendency to anterior or posterior shift; 3) angle between the acromion, the greater trochanter and vertical axis, which checks the vertical alignment of the trunk and a tendency to anterior or posterior trunk shift; 4) angle formed by the acromion, greater trochanter and lateral malleolus, which is called the hip angle,and records a possible tendency to flexion or extension of this joint; 5) the angle formed between the acromion, the lateral malleolus and a vertical line, which checks the vertical alignment of the body and a possible tendency to anterior or posterior shift; 6) angle formed between the anterior superior iliac spine and posterior superior iliac spine and the horizontal on both sides, which verifies the horizontal alignment of the pelvis and possible tendency to anteversion or retroversion; 7) angle formed by the greater trochanter,the knee joint line and lateral malleolus on both sides, which is called the angle of the knee and checks a possible trend towards flexion or extension; 8) angle formed by the knee joint line and the lateral and horizontal malleolus(ankle angle).[8]

The groups were matched and to test the homogeneity between them,the Student's-*t* test was used for age and BMI variables,and the chi-square test for gender and ethnicity. To determine whether patients with HAM/TSP showed orthostatic postural changes similar to each other when compared with the deviations of healthy individuals analyzed, the Student's-*t* test or Mann-Whitney was used. For statistical analyses, the Statistical Package for Social Sciences (SPSS) version 14.0 (USA) was used,with an alpha value less than 5% being accepted as significant.

Figure 1 – Joint angles in anterior (A.V.) and right side view (R.S.V.)



RESULTS

The study included 30 volunteers with HAM/TSP and 30 healthy individuals and there was no loss or exclusion of participants after the selection of volunteers. The two groups, HAM/TSP and comparative, had similar characteristics with regard to sex, age, BMI and race (Table1). The postural profile of the sample of patients with HAM/TSP compared with healthy individuals, characterized by an anterior position

(Mann Whitney,p=0.034) or posterior trunk (Student's-*t* test,p=0.024), body moved forward (Student's-*t*-test,p=0.021), left and right knee in flexion (Mann Whitney, p<0.001 and Student's-*t*-test, p=0.012 respectively) and reduced ankle angle(Student's-*t* Test,p<0.001). These features denote an anterior position relative to the vertical alignment defined by comparing the postural deviations between groups were statistically significant (Table2).

Table 1 – Comparison of characteristics of 30 healthy individuals and 30 HAM / TSP individuals in a Reference Center for HTLV in Salvador/Bahia

	Group HAM/TSP n=30	Group Comparative n=30	p-value
Females	20 (66.7%)	17 (56.7%)	0.426*
Age (years)	50.4 ± 10.3	49.8 ± 7.5	0.798**
BMI (kg/h²)	24.9 ± 5.2	25.5 ± 4.2	0.620**
Color (not white)	28 (93.3%)	27 (90%)	0.640*

* Chi-square test, p<0.05; **Student´s t-test , p<0.05

Table 2 – Comparison of postural deviations in angles between the HAM / TSP group and the comparive group in anterior, right and left sides view

Deviation/angle	Group HAM/TSP N	Group HAM/TSP	Group Comparative N	Group Comparative	p-value
R.V.K.A.V	21	4.5±2.5¹	19	4.1±3.1¹	0.622*
Var.K.A.V.	9	1.7(0.9-5.8)²	11	2.1(0.9-2.9)²	0.790**
L.V.K.A.V	23	4.0±3.0¹	17	4.4±2.5¹	0.699*
L.Var.K.A.V	7	3.6(1.5-9.4)²	13	1.6(0.8-2.9)²	0.104**
A.H.R.S.V.	21	13.4 ± 12.7¹	16	12.7 ± 5.9¹	0.840*
P.H.R.S.V.	5	7.1 (3.3-14.2)²	10	13.8 (4.6-17.3)²	0.327**
H.0R.S.V.	4	13.3%	4	(13.3%)	1***
A.T.R.S.V.	12	4.5(3.2-5.4)²	4	2(0.8-2.8)²	**0.034****
P.T.R.S.V.	18	4.5 ± 3.8¹	26	3.8 ± 2.4¹	0.451*
R.H.F.	13	6.2 (1.1-19.2)²	2	1.3 (1.2 – 1.4)²	0.234**
R.H.E.	17	10.8 ± 5.2¹	28	9.6 ± 5.7¹	0.468*
A.B.R.S.V.	28	2.8 ± 1.3¹	26	2.0 ± 1.0¹	**0.021***
P.B.R.S.V.	2	1.3 ± 0.4¹	4	0.9 ± 0.3¹	0.227*
P.A.R.S.V.	23	15.5 ± 8.8¹	14	12.9 ± 4.8¹	0.315*
P.R.R.S.V.	7	17.7 (2.2-18.4)²	16	12.1(8.1-18.5)²	0.640**

R.K.F.	19	10.5 (7.9 –20.7)[2]	11	0.8 (0.3 – 4.3)[2]	**<0.001****
R.K.E.	11	3.4 (0.9- 6.2)[2]	19	4.1 (1.5 – 7.4)[2]	0.651**
R.R.A.A.	30	81.0 ± 6.1[1]	30	86.8 ± 2.9 [1]	**<0.001***
A.H.L.S.V.	23	11.6 (6.9-18.4)[2]	16	10.7(3.9-14.1)[2]	0.194**
P.H.L.S.V.	7	6.6 (3.2-8.5)[2]	14	7.3 (5.2-16.6)[2]	0.502**
A.T.L.S.V.	9	2(0.8-5.1)[2]	12	1.3(0.6-3.7)[2]	0.412**
P.T.L.S.V.	21	5.1 + 3.7[1]	18	3.0 + 2.2[1]	**0.024***
L.H.F.	9	10.6 ± 7.7[1]	1	1.5	0.154*
L.H.E.	21	9.3 ± 5.7[1]	29	8.1 ± 5.0[1]	0.605*
A.B.L.S.V.	22	3.6 + 1.7[1]	28	2.3 + 1.6[1]	0.700*
P.B.L.S.V.	8	0.2(0.1-0.7)[2]	2	0.7 (0.2-1.2)[2]	0.344**
P.A.L.S.V.	24	13.5 + 7.4[1]	14	14.4 + 3.7[1]	0.662*
P.R.L.S.V.	6	14(0-15.4)[2]	16	0.8 (8.3-19.6)[2]	0.417**
L.K.F.	19	12.8 ± 11.8[1]	13	3.9 ± 2.0[1]	**0.012***
L.K.E.	11	5.4 ± 2.8[1]	17	5.8 ± 5.0[1]	0.806*
R.L.A.A.	30	82.4 + 7.0[1]	30	84.8 + 4.1[1]	0.106*

Legend: R.V.K.A.V.-Right Valgus Knee in Anterior View, R.Var.K.A.V.-Right Varus Knee in Anterior View, L.V.K.A.V.--Left Valgus Knee in Anterior View, L.Var.K.A.V.-Left Varus Knee in Anterior View, A.H.R.S.V.-Anteriorization of Head in Right Side View, P.H.R.S.V.Posteriorization of Head in Right Side View, H.0R.S.V.-Head at 0° in Right Side View, A.T.R.S.V.-Anteriorization of Trunk in Right Side View, P.T.R.S.V.-Posteriorization of the Trunk in Right Side View, R.H.F.-Right Hip Flexion, R.H.E.-Right Hip Extension, A.B.R.S.V.-Anteriorization of the Body in Right Side View, P.B.R.S.V.-Posteriorization of the Body in Right Side View, P.A.R.S.V.-Pelvic Anteversion in Right Side View, P.R.R.S.V.--Pelvic Retroversion Right Side View, R.K.F.-Right Knee Flexion, R.K.E.-Right Knee Extension, R.R.A.A.-Reduction of Right Ankle Angle, A.H.L.S.V.-Anteriorization of Head in Left Side View, P.H.L.S.V.-Posteriorization of Head in Left Side View, A.T.L.S.V.-Anteriorization of Trunk in Left Side View, P.T.L.S.V.-Posteriorization of the Trunk in Left Side View, L.H.F.-Left Hip Flexion, L.H.E.-Left Hip Extension, A.B.L.S.V.-Anteriorization of the Body in Left Side View, P.B.L.S.V.-Posteriorization of the Body in Left Side View, P.A.L.S.V.-Pelvic Anteversion in Left Side View,P.R.L.S.V.-Pelvic Retroversion Left Side View, L.K.F.-Left Knee Flexion, L.K.E.-Left Knee Extension, R.L.A.A-Reduction of Left Ankle Angle,

* Student´s t-test, p<0.05; **Mann-Whitney Test, p<0.05; ***Fisher´s exact test, p<0.05,

[1]Mean ± Standard Deviation, [2]Median (Quartile 25-Quartile 75).

DISCUSSION

The aim of this study was to define the profile of people with postural HAM/TSP; it found a postural trend in this group characterized by the anterior or a posterior trunk position, anterior body position, right and left knee in flexion and reduced ankle angle. Other neurological disorders such as Parkinson's disease, Cerebral Palsy (CP) and Hemiplegia of the spastic diplegia type and spastic paraparesis also have specific postural characteristics. Because it is a neurological disease, postural deviations have many causes. Among the possible causes are:spasticity, muscle weakness, abnormal joint mobility, proprioception and muscle shortening.[9]

Spasticity can generate various signs: muscle weakness, changes in motor phase behavior, hyperactivity of the stretch reflex, abnormal posture, mass movement patterns, inadequate co-contraction and inability to fragment patterns in order to perform an isolated movement of a joint, exaggeration of exteroceptive reflexes of the limbs, Babinski sign and limitation of gait.[10,11] Patients with hypertonia have also impaired reciprocal innervation still committed to maintaining a posture or performance function. Postural adjustments may be impaired in patients with HAM/TSP, because in this situation, there is excessive and stereotyped activity preventing the tonic postural adaptations. Contraction can become static and constant by predominance of hypertonic muscles, which hinders the interaction between the complementary and opposing muscle groups, resulting in a static setting instead of dynamic stability. In cases of children withCP, it has been suggested that the reciprocal inhibition of the corticospinal control via antagonist motor neurons is also not working properly, making muscle control difficult. This can lead to pre-contractions of muscles other than those most important for the movement, associated with difficulty in proximal control. A sequence of abnormal contractions, as well as in HAM/TSP can be explained by the loss of reciprocal inhibition resulting from the co-activation in voluntary movements.[11]

Standing, the interaction of muscle groups, especially those of the pelvis, trunk and legs, has a dynamic nature with constant adjustments, which occur to enable mobility within the support base.[11] Thus, considering that HAM/TSP predominantly affects the lower limbs and pelvis, the mechanism of automatic postural stability must be compromised in this pathology, therefore, likely to cause impairment of static balance, anteriorized posture of the trunk and knee flexion in order to counteract the feeling of risk of falling patients may have, a statement placed in a research that included children with myelomeningocele.[12] Increased muscle tone can be the cause of the misalignment of the orthostasis of patients. This hypothesis suggested that the spasticity of the muscles of the ankle, hip and knee influence the stability of the standing position and gait pattern of children with myelomeningocele.[12] In hypertonia, the muscles may be shortened with a reduction in the number of sarcomeres in series with changes in muscle properties, translated by the transformation of muscle fibers, making them predominantly slow oxidative and decreasing in elastic compliance.[9] The muscle shortening enhances the stretch reflex,and a vicious circle develops,through which the spasticity leads to muscle contractions and this in turn increases spasticity.

[11] The hypertonic and shortened hip and knee flexors may be the cause of limited knee extension.Moreover,the crouch gait of walking in CP may also be triggered by hypertonic and shortened hip flexors,and weak hip and knee extensors.[13] The adductor muscles may also be involved in the changes found, particularly the gracile, who has knee flexor action.[14] Similar to the abnormal posture seen in HAM/TSP and PC, children affected by myelomeningocele exhibited spasticity of the hip flexor muscles leading to a reduction in hip extension, associated with flexion contracture of the joint hip in some cases. The adductor muscles of the hip and knee flexors were also spastic and can justify the anteriorized posture of the trunk and pelvis, hip and knee flexion, with presence of contracture in this position. The dorsiflexion increased by spasticity of the fibular pulling the tibia forward causing secondarily knee flexion. The spasticity in the ankle could have offset this problem bending their pelvis anteriorly and flexing the hip.[12] It is possible that the deviation in hip and knee flexion among patients with HAM/TSP hinders certain muscles to generate force opposing the tendency of postural flexor pathology, which has been observed in patients with crouch gait and reduced the ability of muscles to extend the knee and hip during the stance phase.[15]

Another cause of abnormal posture secondary to HAM/TSP may have been the individual's inability to keep himself/herself in position against gravity due to weakness of the antigravity muscles.[16] Orthostasis particularly requires low-level activation of muscle fibers resistant to fatigue.[17] In orthostasis,the lower back,pelvic and hip regions,an intermittent activity of the gluteus medius,tensor fasciae latae and posterior muscle of the thigh is necessary to control the oscillations of posture; and the presence of constant activity in the iliopsoas muscle to support the iliofemoral ligament in the hip joint as well as in the internal oblique absominal muscle to protect the internal oblique iguinal channel. All other muscles stay at rest in an ideal standing position.[18] Individuals with HAM/TSP have decreased mobility, which may be associated with weak gluteus and abdominal muscles causing hip flexion and pelvic instability. The lack of support from the neutral position of the pelvis can cause the misalignment of the lower limbs causing knee flexion to counteract the center of mass shift.[19] This center of mass shift, in turn, can lead to anteriorized trunk and head. As a consequence of exaggerated knee flexion, there could be a reduction in ankle angle. Moreover, the inability to maintain a neutral position of the ankle may be due to paresis of the plantar flexors, and the resulting anteriorization of the tíbia, causing instability in orthostasis and demanding compensation of other joints such as the trunk to maintain a stable posture.[12] It is also possible that weakness of the rectus femoris is present,which stresses the knee flexion, enhancing the flexor posture of the hip. Weakness or impaired motor control can also occur in the transversus abdominis and lumbar mutifídios, undermining lumbopelvic stability.[19] This situation may trigger compensation in posture in order to maintain the center of balance projected in the support base.

The distinct findings of anterioriorization and posterioriorization of the trunk in the profiles of the trunk right and left, respectively, can be explained by the presence of rotation of the trunk to the left creating an impression of posterioriorization of the trunk in the left profile. This feature is understood by the inability of the evaluation method used to directly identify misalignments in the transverse plane plane of the body.[20] One hypothesis for the rotation may involve the left hemisphere cerebral dominance of the majority of the sample, expressed by a large number of right-handed individuals. The asymmetric weight distribution generated by rearrangement of the body segments, and the proprioceptive deficits of the individuals in this study, may also result in losses in static balance and postural adjustments.[16] The spinal cord involvement may be more localized in a region,causing asymmetric neuromusculoskeletal disturbances with changes in the transverse plane.

The postures and movements are driven by a combination of motor programs and sensory feedback.[11] Any interruption in the cyclic events of neural activity will affect the outcome.If there is an abnormal postural tone as a result of a neurological injury, there may be a disordered movement or a limited repertoire of movement,producing an abnormal sensory input to the Central Nervous System.This can lead to a response that is produced by stress and/or compensation,which in turn produces an abnormal movement and abnormal posture adjustment.[11] In posture control,the proprioceptive is an important system that changes in neurological patients,generating changes in the disposition of a body segments and in the alignment of the center of mass from the base of support.[16] Proprioceptive sensory loss can occur in individuals with HAM/TSP and this can be one of the components that generate postural alterations.[3]

The limitations of this study are related to the static nature of the postural examination, which may limit interpretations related to locomotor function and inferences about the generalization of findings.Postural assessment, performed by means of two-dimensional processing, not adjusted for fluctuations in the center of mass may prevent conclusions.The imaging processing includes a protocol of photographs taken during careful apnea after inspiration, reducing the influence of oscillations of the center of mass. The right-handed dominance of the majority of the sample, could also be considered a limitation of the study, since this aspect can influence the posture. However, the convenience sample of the research was developed at a center of reference and the method was applied strictly in accordance with the SAPO tutorial. It is suggested that future studies assess the muscle electrophysiology and dynamic postural behavior,and the postural evaluation protocols should be indicated for monitoring/following up functional interventions.

The findings encourage the inclusion of a rehabilitation program involving postural approaches in the profile of the patient, in order to improve their daily life activities in daily living, since the positioning and appropriate movements to maintain and restore muscle and joint range of motion,are essential to ensure the optimal level of function of each individual.

CONCLUSION

The postural profile of people with HAM/TSP manifests itself with changes in the sagittal plane.

Conflict of interest statement

The authors declare to have no conflict of interest in this work.

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