# 141 - USE OF VIBRATORY STIMULATION IN THE REDUCTION OF SPASTICITY IN PATIENTS AFTER CEREBROVASCULAR ACCIDENT: LITERATURE REVIEW

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## INTRODUCTION

Currently, many individuals survive CVA (cerebrovascular accident) and live with some functional incapacity, presenting clinical manifestations based on the place and size of the lesion, resulting in paresis or paralysis of the contralateral side. The motor signals are characterized in the initial stages by deficit signals with partial or complete loss of the voluntary and selective movement control, and, in an intermediate stage, with signals of pyramidal release, which generates speed dependent hypertonia; hyperreflexia; clonus and alterations in cutaneous reflexes (ROPPER 2005 apud PAZ, MARÃES and BORGES 2011; MEDEIROS et al, 2002 apud WOELLNER et al, 2012; MARTINS et al, 2007 apud SOARES et al, 2012; FEIGIN, 2005 apud ARAÚJO and BARBOSA, 2013; SOUZA et al, 2014).

The spasticity occurs from a lesion in the central nervous system that reaches the superior motor neuron, leading to an increase of the speed and excitability of the tonic stretching reflexes; an increase of the resistance to passive speed dependent movement; an increase of the stretching reflexes in phasic muscles and excessive tendon reflexes; it generates the loss of movement selectivity and reciprocal inhibition, characterized by the simultaneous contraction of agonistic and antagonistic muscles, intervening in the speed and quality of movements' execution. The measurement of the spasticity is carried through by using neurophysiologic, clinical or biomechanical evaluation, that leads to the application of techniques and therapeutic exercises in order to optimize the recovery of the sensory-motor function (BHAKTA, 2000 apud LUVIZUTTO and GAMEIRO, 2011; GRAHAM, 2013; COSTA et al, 2013; LANCE, 1980 apud FANG, YUEDI and I READ 2014).

The vibratory stimulation, after being long forgotten by the scientific and clinical community, began once more to be suggested as a therapeutic modality for spasticity's treatment. This vibration refers to mechanical oscillations around a reference position, which is defined by frequency and amplitude. The frequencies are measured in Hertz (Hz), they are related to the repetition rates of the oscillatory cycles per second. The amplitude, on the other hand, is measured in millimeters (mm) and it is related to the dislocation extension of the vibratory base. Several devices that produce vibration are being developed, such as: platforms; cushions; dumbbells and mats. Studies are carried through in parallel to prove their efficiency (RAUCH, 2009 apud OLIVEIRA et al, 2011; SILVA and SCHNEIDER 2011) based in the well-known important physiological effects of the muscle tendineae vibration.

The sensations are related to the somatosensory system, therefore all the receivers answer to vibratory stimulations, however, the cutaneous and the muscle ones are the most sensible. The rapid action receptors, like Pacinian corpuscles are activated by vibratory frequencies ranging from 30 to 1.500Hz, with better activation from 200 to 400Hz and amplitude of 1 mm; and the Meissner's corpuscle is activated by frequencies inferior to 300Hz with excellent response from 40 to 50Hz and the amplitude higher than 8 mm. They respond only at the beginning and in the end of the stimulus. They are better activated by vibration when compared with the receivers of slow adaptation, as the Merkel Disk receptors and the Ruffini Corpuscles, which respond once for each vibration cycle with frequency of up to 200Hz in a continuous way, from the beginning until the end of the stimulus. Thegolgi tendon organs are activated by vibration; however they are less sensible (BECK, GRANDSON and NOHAMA, 2010).

Generally, professionals apply a vibratory stimulus to a specific muscle, using a mechanical device that generates muscle activation in the primary terminations of the spine, increasing the excitability of the corticospinal tract. We characterize it by a larger number of activated corticospinal fibers; greater amount and force of synapses, which were created by each one of these fibers on each spinal motor neuron; and increase of the speed of conduction by the activation of the motor neurons of high excitation threshold, through the modulation of inhibitors and intra-cortical facilitators for the primary motor cortex (ROLL, VEDEL and RIBOT, 1989 apud MIYARA et al, 2014; ROSENKRANZ, ROTHWELL, 2003 apud MIRAYA et al, 2014; VASCONCELLOS, SCHUTZ and SAINTS, 2014). We can notice a decrease of monosynaptic response in the vibrated muscle via increase of pre-synaptic inhibition and depression of neurotransmitters (DELWAIDE, 1973; ROLL et al., 1980), as well as increase of the antagonist's reciprocal inhibition to the vibrated muscle (OF GAIL et al., 1966).

The objective of this study was to identify, through bibliographical review, articles that evaluate the effect of the vibratory stimulation in the spasticity's modulation in patients after CVA.

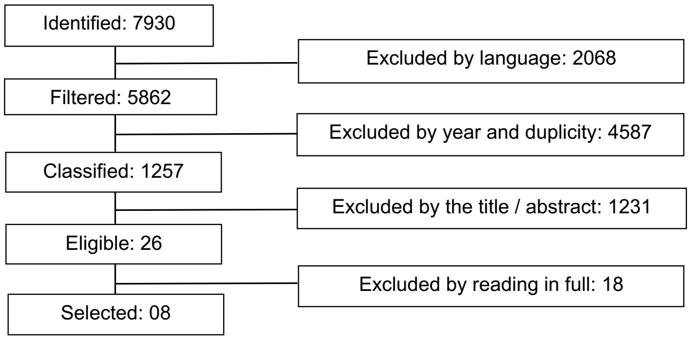
## METHOD

We used a systematic review, carried through in the period between February and May of 2015. We searched for studies indexed in the electronic databases SCIELO (Scientific Eletronic Library Online) and BIREME (Health Virtual Library), using the keywords: “spasticity”; “rehabilitation”, “cerebrovascular accident”; “vibratory/vibration”. We adopted, as inclusion criteria, studies published in Portuguese and in English, filtered by the year of publication between 2010 and 2015.

## RESULTS AND DISCUSSION

We found 7930 articles that approached the subject. Of these, 118 were found in the SCIELO database, where 04 attained the established criteria of inclusion. In the BIREME database, we found 7812 articles, from which 22 matched the inclusion criteria. We considered 08 articles for reviewing, as presented in figure 1.

Figure 1: Flow chart of the studies found.




The table 1 shows the results of 8 articles included in the study.

Table 1: Table 1 - Analysis of the articles selected.

| AUTHOR YEAR | TECHNIQUES | | | | | | | RESULT |
|---|---|---|---|---|---|---|---|---|
| | n | VPD | F (Hz) | A (mm) | Position | MLA | AT (min) | |
| CORDO et al (2009) | 20 | Robotic device for motor training | 60-70 | 2-3 | LL in extension | Anterior Tibialis ; medial head triceps surae gastrocnemius | 30 | Improvement of the motor condition; walking stability |
| SILVA; LIMA; JÚNIOR (2011) | 27 | Vibratory cushion | 80 | 1,8 | Seated | Anterior Tibial and medial head surae gastrocnemius | 15 | Tonus modulation; increase of MA in ankle dorsiflexion. |
| CALIANDRO et al. (2012) | 28 | Electromechanical transducer | 100 | 0,2-0,5 | UL in supine | Pectoralis minor muscle; brachial biceps and carpus flexors | Each muscle 10 Interval 1 For 3 days. | Improvement of the functional capacity. |
| CHAN et al. (2012) | 30 | Platform Vibratory | 12 | 4 | Half-crouch | Vibration of entire body | 2 periods 10 Interval 1 | Position and walking speed improvement; spasticity reduction. |
| NOMA et al. (2012) | 36 | Vibratory stimulus Device | 91 | 1 | UL in extension | Brachial biceps; fist flexors and fingers flexors | 5 | Spasticity decrease in UULL. |
| ARAUJO and BARBOSA (2013) | 12 | *eletromyographic Feedback* | 10 | 10 | UL in extension | Arm, forearm and hand's flexors and extensors | 50 3x a week For 8 weeks | Improvement of the motor function. |
| MIYARA et al. (2014) | 25 | Vibratory platform | 30 | 4-8 | Seated | Hamstring; gastrocnemius and soleus | 5 | MA increase in ankle dorsiflexion and walking speed. |
| TANKISHEVA et al. (2014) | 30 | Vibratory platform | 35-40 | 1,7-2,5 | Crouching in 50º, 60º, 90º | LLLL | 1 7 to 17 repetition 3x a week For 6 weeks | Postural control and knee extention strenght's improvement. |

Legend: n - amount of patients; VPD - vibration producer device ; F - frequency; A - amplitude; MLA - muscle location applied; AT - application time; VS - vibratory stimulus; MA - movement amplitude; UL- upper limb; LL - lower limb; MMAA - upper limbs; LLLL - lower limbs.

In the eight articles presented in table 1 and described in this review, the effects of the vibratory stimulation in spasticity were evaluated in 208 individuals with CVA.

The general analysis of these articles, showed the variety of parameters used to reduce motor spasticity and other motor components through the use of vibratory stimulations. However, fourteen articles did not present detailed data, neither a comparison of its effectiveness. This is a criterion that can't be on the referred table.

Cordo et al (2009) apud Beck, Neto and Nohama (2010), evaluated spastic patients by using a device made for motor training in antagonistic muscles, with daily application of 30 minutes in a treatment period of 6 months. To reduce spasticity, extension movements were carried through in a opposite way to the spastic pattern. The result showed improvement of the motor condition and walking stability, the improvement remained for 6 months after the treatment.

Silva, Lima and Júnior (2011), investigated the immediate and short duration effects of the vibratory stimulation in the spasticity of the lower limbs of hemi-paretic patients. The electromyography activity registers after vibratory stimulation of the tibialis anterior muscle showed a significant increase in the immediate one (p<0.01). Comparing the rate 5 minutes and 10 minutes after didn't show any difference. We didn't notice significant differences in the post-immediate treatment on the gastrocnemius head medial muscle. After 5 minutes (p<0.05) and after 10 minutes (p<0.01) the difference was significant. We noticed a significant increase (p<0.0001) in the ankle's motion amplitude. The results indicate muscle tonus modulation and improvement of the functional capacity, according to the responses obtained by different stimulations.

Caliandro et al (2012), examined the effect of repetitive muscular vibratory stimulation in the UL's motor function of hemi-paretic and hemiplegic patients. They assigned their patients to a group of studies that received vibration, and a control group that received placebo vibration treatment. They used scales to score the results. The variance analysis for repeated measures showed a significant difference in the WMFT (Wolf Motor Function Test) score only in the group of studies (p=0.006) and no difference in the control group. The MAS (Modified Ashworth Scale) and AVS (Analogical Visual Scale) didn't present significant differences in the two groups. The result presented in WMFT suggests that the treatment with repetitive focal vibration on the UL improves the functional capacity.

Chan et al (2012), determined the vibration capacity of the entire body to reduce the spasticity in patients with CVA. They divided the participants in an intervention group (which received only one session of vibration on the entire body through a platform) and a control group (positioned with the platform turned off). While being evaluated through MAS, the punctuations were significantly different in all body vibration (p<0.0001), demonstrating spasticity reduction. The deep reflexes of the Achilles tendon were evaluated in the affected side and it didn't present significant differences between the groups. A chronometric test used to evaluate balance demonstrated improvement in the group of "entire body vibration" (p<0.003). The 10 meters walk test, used to evaluate walking, presented significant speed improvement in the vibration group (p=0.039), however, the cadence performance was not significant (p=0.277). The study demonstrated that one single session of vibration of entire body provides improvement in the position and walking speed and reduces the spasticity in the ankle's plantar flection.

Noma et al (2012) investigated if the direct application of vibratory stimulation inhibits UULL's spasticity in hemiplegic patients. They divided the patients in two groups: the "rest group" and the "stretching group". Patients were put in dorsal decubitus, relaxed for 30 minutes, after that, they received the intervention for 5 minutes. In the "stretching group" the F wave parameters measured immediately after the stretching had decreased, but not in MAS, this tendency had disappeared 30 minutes after. In the "rest group" the F wave parameters and MAS scores had remained 30 minutes after the intervention. The vibratory stimulations produce, initially, intense contraction of the spastic muscles, after some minutes the contraction disappears and the spasticity is suppressed for more than 30 minutes without stimulation.

Araújo and Barbosa (2013) compared the effect of two training programs: the conventional physiotherapy associated with functional training and a functional training associated with electromyographic feedback. During 25 minutes, they carried out repetitions of flexion and extension movements of the elbow, fist and hand articulations; then, for 25 minutes more they carried out movements to reach out objects. The Fugl-Meyer Assessment (FMA) showed improvement in motor function (p=03) in both groups; the TEMPA (Test D'Évaluation dês Membres Supérieurs de PersonesÂgeés) identified positive results in six of the eight tasks assessed and in the total score; the Ashworth Scale presented spasticity reduction. Although we haven't observed statistical difference, the results show that the spastic reduction can have positively influenced the functional improvement of both groups.

Miyara et al (2014) had investigated the adaptation of vibratory stimulations in hemiplegic patients. They put the patients on the vibratory platform, seated with their hip in an articulate angle of 90º of flexion and their knee extension of 0º and maximum dorsiflexion of the ankle, relaxed for 5 minutes; after that, they received the interventions for a 5 minutes period. Those evaluated by MAS scores presented significant reduction in the expository muscles of the hip (p=0.002); hamstring muscles (p=0.001) and gastrocnemius muscles (p=0.002). The 10 minutes' walk test used to evaluate the capacity of walking, presented significant improvement (p=0.002). The dorsiflexion movement amplitude showed significant increase (p= 0.001). The entire body vibration decreased the muscle tonicity, increased the ankle's dorsiflexion movement amplitude, improved the movement speed and cadence.

Tankisheva et al (2014), investigated the effect of the entire body's stimulation for 6 weeks. They divided the patients into a "vibration group" and a control group. The two groups were evaluated through Barthel Index and they didn't presented differences (p>0.05). The MAS's scores didn't present significant differences (p>0.05). The muscle strength test evaluated by isokinetic dynamometer showed difference (p=0.022) in the knee extension, with a 60º vibration angle. In what concerns balance, they oscillated between increasingly difficulty and showed an increase of p<005. The study sample shows that after 6 weeks of vibration may have potential benefic effects in the knee's muscle strength and balance control. This is the result of different dynamic exercises done on the platform.

## CONCLUSION

The vibratory stimulations are efficient according to the knowledge about neurophysiologic mechanisms. The vibration's mechanic action produces fast and small changes in the length of the tendon-muscle complex; it generates movement illusions and body changes; it improves the muscle strength; it facilitates the voluntary movement and it reduces the spasticity. Stimulation protocols must be used to attenuate the undesirable effects emerging from adaptation, so the effectiveness of the treatment doesn't diminish. Moreover, no adverse effect was mentioned, supporting the potential of this resource.

We suggest that new studies should be made to determinate the ideal stimulation parameters in order to facilitate the fact that the so acknowledged physiologic effects become clinically significant effects.

## REFERENCES

ARAÚJO, R. C.; BARBOSA, M. P. Efeito da fisioterapia convencional e do feedback eletromiográfico associados ao treino de tarefas específicas na recuperação motora de membro superior após acidente vascular encefálico. Motricidade 2013. Vol. 9, n. 2, p.23-36.

BECK, E. K.; NETO, G. N. N.; NOHAMA, P. Estímulo vibracional na espasticidade uma perspectiva de tratamento. Rev. Neurociência 2010. Vol. 18, p.523- 530.

CALIANDRO, P. et al. Focal muscle vibration in the treatment of upper limb spasticity: a pilot randomized controlled trial in patients with chronic stroke. Arch Phys Med Rehabil. 2012. Sep; 93 (9): 1956-61.

CHAN, K. S. et al. Effects of a single session of whole body vibration on ankle plantarflexion spasticity and gait performance in patients with chronic stroke: a randomized controlled trial. Clinical Rehabilitation 2012. Vol. 26: p.1087-1095.

CORDO P et al. Assisted movement with enhanced sensation (AMES): Coupling motor and sensory to remediate motor deficits in chronic stroke patients. Neuro Rehabilitation and Neural Repair. 2009; 23(1):67-77.

COSTA. T. D. A. et al. Análise do controle postural após a aplicação da eletroestimulação funcional no acidente vascular encefálico. Acta. Fisiatr. 2013. Vol. 20 (1) p.50-54.

DE GAIL P, LANCE JW, NEILSON PD. Differential efffects on tonic and phasic reflex mechanisms produced by vibration of muscles in man. J Neurol Neurosurg Psychiatry. 1966 Feb; 29:1-11.

DELWAIDE P. Human monosynaptic reflexes and presynaptic inhibition: An interpretation of spastic hyperreflexia. Basel: Karger, 1973.

FANG, L.; YUEDI, W.; LI, X. J. Reliability of a new scale for measurement of spasticity in stroke patients. J. Rehabil Med. 2014. Vol. 46: p.746-753.

GRAHAM, L. A. Management of spasticity revisited. Oxford Journals Medicine e Health. 2013. Vol. 42: p.435-441.

LUVIZUTTO, G. J.; GAMEIRO, M. O. Efeito da espasticidade sobre padrões lineares de marcha em hemiparéticos. Fisioter. Mov. 2011. Curitiba (PR). Vol. 24 n. 4, p.705-712.

MIYARA, M. K. et al. Feasibility of using whole body vibration as a means for controlling spasticity in post-stroke patients: A pilot study. Comple Ther Clin Pract. 2014. Vol. 20 (1): 70-3.

NOMA, T. et al. Anti-spastic effects of the direct application of vibratory stimuli to the spastic muscles of hemiplegic limbs in post-stroke patients: a proof-of-principle study. J. Reahabil Med. 2012. Vol. 44 (4): 325-30.

OLIVEIRA, W. L. et al. 2011. Análise da influência da plataforma vibratória no desempenho do salto vertical e, atletas de futebol: ensaio clínico randomizado. Fisioter. Mov. 2011. Vol.24 n 2.

PAZ, L. P. S.; MARÃES, V. R. F. S.; BORGES, G. Relação entre a força de preensão palmar e a espasticidade em pacientes hemiparéticos após acidente vascular cerebral. Acta Fisiatr. 2011. Vol. 18: p.75-82.

ROLL JP, GILHODES JC, TARDY-GERVET MF. Perceptive and motor effects of muscular vibrations in the normal human: demonstration of a response by opposing muscles. Arch Ital Biol 1980 Mar;118(1):51-71.

SILVA, J. M.; LIMA, M. O.; JÚNIOR, A. R. P. Efeito agudo da estimulação vibratória em hemiparéticos espásticos pós-acidente vascular encefálico. Rev. Bras. de Eng. Biom., 2011. Vol. 27 n.4, p.224-230.

SILVA, P. Z.; SCNEIDER, R. H.; Efeitos da plataforma vibratória no equilíbrio em idosos. Acta Fisiatr. 2011. Vol.18 (1): 21-26.

SOARES A. V. et al. Estimulação elétrica funcional na recuperação do membro superior de hemiparéticos após acidente vascular encefálico. Acta Fisiatr. 2012. Vol.19 (4): 203-6.

SOUZA, J. O. et al. Influência da estimulação elétrica neuromuscular e cinesioterapia nos movimentos de pacientes hemiparéticos. ConScientiae Saúde, 2014. Vol. 13. n 2 p.246-251.

TANKISHEVA, E.; et al. Effects of intensive whole-body vibration training on muscle strength and balance in adults with chronic stroke: a randomized controlled pilot study. Arch Phys Med Rehabil. 2014: 95 (3): 439-46.

VASCONCELLOS, R. P.; SCHUTZ, G. R.; SANTOS, S. G. The interference of body position with vibration transmission during training on a vibrating platform. Rev. Bras. de Cineantrop. e Desem.Hum. Florianópolis (SC), 2014. Vol. 16, n.6.

WOELLNER, S.S.; et al. Treinamento específico do membro superior de hemiparéticos por acidente vascular encefálico. Arq. Catarin. Med. 2012. 41 (3) p.49-53.

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**USE OF VIBRATORY STIMULATION IN THE REDUCTION OF SPASTICITY IN PATIENTS AFTER CEREBROVASCULAR ACCIDENT: LITERATURE REVIEW.**

**ABSTRACT**

INTRODUCTION: The vibratory stimulation is a rehabilitation technique that promotes the activation of the somatosensory system through segmentary vibration or vibration on the entire body. The oscillatory waves generated by the vibration applied on patient are caught by peripheral receivers, they cause movement illusion and lead to the neural plasticity. Objective: to verify the effect of the vibratory stimulation in the spasticity modulation in patients after CVA. Method: bibliographical review of scientific articles, published from 2010 to 2015 in the SCIELO and BIREME databases were used. Results: 7735 articles that appoached the subject were found, 08 of them fitted the inclusion criteria. Conclusion: The vibration stimulus are effective, because the vibration's mechanic action produces fast and small changes in the length of the tendon-muscle complex; it generates movement illusions and body changes; it improves the muscle strenght; it facilitates the voluntary movement and it reduces the spasticity.

**KEYWORDS:** “spasticity”; “rehabilitation”, “cerebrovascular accident”; “vibratory/vibration”.

**UTILISATION DE LA STIMULATION VIBRATOIRE DANS LA REDUCTION DE LA SPASTICITE CHEZ LES PATIENTS POST-ACCIDENT VASCULAIRE CEREBRAL : REVUE DE LITTERATURE**

**RÉSUMÉ**

Introduction: la stimulation vibratoire est une technique de réhabilitation qui favorise l'activation du système somato-sensoriel par une vibration ciblée ou dans le corps entier. Les ondes oscillatoires générées par la vibration appliquée aux patients sont captées par des récepteurs périphériques, provoquant l'illusion d'un mouvement et conduisant à une plasticité neurale. Objectifs: vérifier les effets de la stimulation vibratoire sur la réduction de spasticité chez les patients post-AVC. Méthode: A été utilisée la revue bibliographique des articles scientifiques publiés de 2010 à 2015 dans les bases de données SCIELO et BIREME. Résultats: Ont été initialement trouvés 7735 articles qui abordaient le thème, dont 8 conformes aux critères d'inclusion. Conclusion: les stimulations vibratoires sont efficaces, puisque l'action mécanique de vibration produit des changements courts et rapides dans la longueur du muscle tendineux complexe génère des illusions de mouvements et changements corporels, améliore la force musculaire, facilite le mouvement volontaire et réduit la spasticité.

**MOTS-CLÉS:** spasticité, réhabilitation, accident vasculaire cérébral, vibration/vibratoire

**USO DE LA ESTIMULACIÓN VIBRATORIA EN LA REDUCCIÓN DE ESPASTICIDAD EN PACIENTES POST ACCIDENTE VASCULAR ENCEFÁLICO: REVISIÓN DE LA LITERATURA.**

**RESUMEN**

Introducción: La estimulación vibratoria es una técnica de rehabilitación que promueve la activación del sistema somato sensorial a través de vibración segmentaria o en el cuerpo entero. Las ondas oscilatorias generadas por la vibración aplicadas al paciente, son captadas por receptores periféricos, causan la ilusión de movimiento y llevan a la plasticidad neuronal. Objetivo: verificar los efectos de la estimulación vibratoria en la modulación de la espasticidad en pacientes post AVE. Método:

fue utilizada la revisión bibliográfica de artículos científicos publicados de 2010 a 2015 en las bases de datos SCIELO y BIREME. Resultados: fueron encontrados inicialmente 7735 artículos que abordaban el tema, siendo que 08 se encuadraron en los criterios de inclusión. Conclusión: los estímulos vibratorios son eficaces, pues la acción mecánica de la vibración produce rápidos y cortos cambios en el comprometimiento del complejo músculo-tendinoso; genera ilusiones de movimiento y cambios corporales; mejora la fuerza muscular, facilita el movimiento voluntario y reduce la espasticidad.

**PALABRAS CLAVE:** “espasticidad”, “rehabilitación”, “accidente vascular encefálico”, “vibración/vibratoria”.

**USO DA ESTIMULAÇÃO VIBRATÓRIA NA REDUÇÃO DA ESPASTICIDADE EM PACIENTES PÓS-ACIDENTE VASCULAR ENCEFÁLICO: REVISÃO DA LITERATURA.**

**RESUMO**

Introdução: A estimulação vibratória é uma técnica de reabilitação que promove a ativação do sistema somatossensorial através de vibração segmentar ou no corpo inteiro. As ondas oscilatórias geradas pela vibração aplicadas ao paciente são captadas por receptores periféricos, causam ilusão de movimento e levam à plasticidade neural. Objetivo: verificar os efeitos da estimulação vibratória na modulação da espasticidade em pacientes pós-AVE. Método: foi utilizada revisão bibliográfica de artigos científicos publicados de 2010 a 2015 nas bases de dados SCIELO e BIREME. Resultados: foram encontrados inicialmente 7735 artigos que abordavam o tema, sendo que 08 enquadraram-se nos critérios de inclusão. Conclusão: Os estímulos vibratórios são eficazes, pois a ação mecânica da vibração produz rápidas e curtas mudanças no comprimento do complexo músculo-tendíneo; gera ilusões de movimento e mudanças corporais; melhora a força muscular; facilita o movimento voluntário e reduz a espasticidade.

**PALAVRAS-CHAVE**: “espasticidade”; “reabilitação”, “acidente vascular encefálico”; “vibração/vibratória”.