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Literature Review

HEMINEGLECT: A Review of the Literature

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Abstract

Patients suffering a cerebrovascular accident (CVA) may have numerous types and combinations deficits, including sensory, motor, communication or cognitive alterations (attentional, executive disorders and recognition deficits). Hemineglígence is a cognitive deficit characterized by common behavioral syndrome in stroke patients. Hemineglígence has been defined as failure to report, orienting toward or responding to stimuli generated on the side opposite the cortical lesion; in this case, the changes are not primarily attributable to the sensory and motor deficits possible present. Because the syndrome presents an unfavorable prognosis, having a diverse clinical presentation and does not respond satisfactorily to the conventional treatments of physical rehabilitation, different treatment strategies have been developed such as: activation of negligent limb, restriction and motion induction therapy, somatosensory stimulation, mental imagination, prism lenses, visual scanning and other approaches. In conclusion the techniques described here represent what we find most relevant in terms of rehabilitation of the patient with hemineglígence and can be used isolated or in combination, but the individuality of each patient should be taken into account.

Keywords: *Rehabilitation; Heminelect; Cerebrovascular Accident (CVA)*

Introduction

Patients suffering a cerebrovascular accident (CVA) may have numerous types and combinations deficits, including sensory, motor, communication or cognitive alterations (attentional, executive disorders and recognition deficits) [1] Hemineglígence is a cognitive deficit characterized by common behavioral syndrome in stroke patients (Cerebrovascular accident –CVA) [2]. However, in this syndrome, the cognitive impairment is basically attentional [3].

Hemineglígence has been defined as failure to report, orienting toward or responding to stimuli generated on the side opposite the cortical lesion; in this case, the changes are not primarily attributable to the sensory and motor deficits possible present [4]. Therefore, hemineglígentes patients find it difficult to direct attention to the side contralateral to the cortical lesion which leads to a lot of impact on activities of daily living. It is common to observe these patients colliding with objects and people located on the neglected side, eating

only the food located on one side of the dish, not being able to read newspapers and magazines for not observing words that are in the negligent hemicampo, besides making themselves up or shaving only half the face [5].

The syndrome does not present itself in a uniform way, being, however, constituted by a series of symptoms and manifestations in different combinations [6,7].

The specialized literature strongly suggests that hemineglected patients have a worse prognosis when compared with those without the problem [8-10]. Thus, the severity of the stroke, together with the presence of heminelect, is related to worse prognosis in activities of daily living (ADL), higher rates of morbidity and lethality, and longer hospital stay [11]. Hemychopathic patients present, on average, greater sensory and motor involvement, greater cognitive impairment, and have lower scores on functional independence scales when compared to those without the condition [12]. In addition, contrary to what one imagines, heminelect is not a rare syndrome [13]. Nevertheless, some studies [14,15] show that there are few professionals involved in stroke rehabilitation who use diagnostic criteria and rehabilitation techniques based on recent scientific evidence. Would we be neglecting hemineglígence?

The diversified nature of hemineglect makes identification, evaluation, and selection of an appropriate treatment strategy a complex task. Moreover, the seriousness of the problems and their consequences in everyday life make it possible to understand to what extent studies on hemineglect are important.

Hemineglect Rehabilitation

Because the syndrome presents an unfavorable prognosis, having a diverse clinical presentation and does not respond satisfactorily to the conventional treatments of physical rehabilitation, different treatment strategies have been developed. In the following paragraphs the main strategies published and used for the rehabilitation of hemineglect will be presented.

Activation of negligent limb

This therapeutic approach seems to present satisfactory results in the treatment of hemineglect [16]. Through active movements on the opposite side of the cortical lesion, some patients showed significant improvement in their gait trajectory [17], reading tasks [18] and performance in specific tests such as the "Cancellation Test" [19]. Some authors also report that, to treat hemineglect, the activation of the negligent limb would be better than bilateral activation [20]; this could be explained by a possible competition between the healthy hemisphere and the injured one. A recent review article confirms the evidence of benefit of this modality of treatment in hemineglect [21].

Heminelect may be associated, usually in the acute phase, with the phenomenon of extinction, that is, patients are able to perceive unilateral stimuli; when the stimulus is bilateral, however, it only perceives stimulation on the same side of the cortical (ipsilesional) lesion, neglecting the stimulus on the side opposite the lesion (contralesional) [22]. It is thus believed that, in the acute phase, bilateral activities should be avoided and tasks encouraged with the negligent member. However, one limitation found for this therapeutic approach is the patient's need to actively move the contralateral limb to the brain lesion, which means to have a force degree greater than 3.

Restriction and motion induction therapy

Restriction and motion induction therapy (RMIT) was originally used in chronic phase stroke patients; consists of immobilizing the healthy upper limb, leaving only the free paretic member to perform the ADL. According to the original protocol, the patient should undergo supervised therapy 6 hours a day for two weeks and an immobilizing orthosis should remain in the healthy arm for approximately 90% of the hours the patient is awake [23]. RMIT is based on the principle of non-use learned, which suggests that after frustrating experiences with the affected upper limb, patients might have 'learned' not to use it even in functions where it would have the potential to perform them. Investigation on the use of RMIT in patients with negligence was performed in only one study that included patients with and without hemineglect. Patients with hemineglect were the most benefited by the training that compared the technique with traditional rehabilitation, suggesting functional improvement in the affected arm; the improvement was not, however, long lasting.

A limitation in relation to this technique is the need for the patient to have an active extension of at least 10 to 20 degrees of wrist and fingers, which eliminates a good part of the negligent patients, who usually present dense hemiparesis. However, not using the opposite side to the cortical lesion in hemineglect is not only caused by hemiparesis [7], but it may be due to personal negligence, which makes this technique a potentially important resource for this group of patients.

Somatosensory stimulation

Somatosensory stimulation includes, for example, the use of vibratory stimuli in the neck. This technique assumes that the vibratory stimulus promotes afferent information to the central nervous system [24]. Such stimuli are interpreted as a variation of muscle length; thus, in the absence of visual input, a distortion of the body would be perceived, which would result in a possible spatial reorientation. The conventional treatment associated with vibratory stimuli in the neck muscles, when compared with conventional rehabilitation alone, provided better results in the treatment of hemineglect [25]. It was also observed that the electrical stimulation on the left side of the neck allows a better score in the "pencil and paper" tests that evaluate sensorial and representational heminelect [26].

One limitation of this technique is that the apparent beneficial effects do not seem to persist after the end of the stimulus, not promoting sustainable real gains for the patient.

Mental imagination

In the last decade, with the emergence of new neuroimaging technologies, such as positron emission tomography (PET) and functional magnetic resonance imaging (MRI), the concept of mental imagination has been used as a rehabilitation strategy. Mental Imagination occurs when perceptual information is accessed through memory, giving rise to an experience of "seeing with the eyes of the mind, listening with the ears of the mind" and so on [27].

The motor imagination is one of the modalities of the mental imagination. Neuroimaging studies and physiological investigations point to a strong correlation between motor imagery and motor action, both dependent on similar cortical processes [28,29]. Motor imagery differs from motor execution primarily through processes involving motor inhibition or suppression. It is believed that the posterior part of the cerebellum promotes inhibition of movement during motor imagery; other authors suggest that the parietal lobe is involved in this inhibitory process [30].

In a recent study evaluating 46 patients after a stroke, it was demonstrated that the motor imagination leads to attentional improvement, associated with improvement in motor planning and movement execution. These effects provided a greater functional ability of the studied patients [31]. Other authors also point out the advantages of motor imagination in the rehabilitation of stroke patients [32]. In the study [33], using only the motor imagination (imagination of the movement with the limb contralateral to the cortical lesion) the negligent symptoms in a patient significantly diminished; however, in another patient, this decrease was not significant. This study also pointed out a relevant fact: the motor imagination with the healthy limb intensified the negligent symptoms. The existence of an inter - hemispheric relation in the motor functions could justify this exacerbation of the symptoms of hemineglect.

Another modality of the mental imagination used in the rehabilitation of negligent patients is the visual imagination. Studies indicate the involvement of attentional processes in this mental imagination mode. Concomitant with the support of attention, during the visual imagination the individual is able to promote the exchange and selectivity of attention to restricted parts of the image. Thus it is possible to conclude that there is a relation between the visual imagination and the visual exploration itself [34]. As visual exploration and attention support are the basis for the rehabilitation of heminegency in many studies, visual imagery emerges as another important tool.

In the work of Smania., *et al*. [35], Hemine-peripheral patients received visual imaging tasks associated with motor imagery, and at the end of treatment significant improvement was demonstrated through proper tests for heminelect and functional tests. In addition, patient follow-up demonstrated that gains were maintained after six months of treatment completion. Another author [36] also used vi-

sual imagery to treat hemineglect patients. In that study, negligent symptoms were initially assessed by specific tests, and after this initial assessment, the design of a headlamp was presented to the patients. They had to imagine that their eyes were the headlamp lights and they had to light the sea, from left to right, so that the ships had the ability to navigate safely. After the visual imagery exercise, the patients were again submitted to the initial evaluation. After three sessions, improvement of the negligent symptoms was observed.

Review articles on the possible treatments for hemineglect report that the mental imagination may be a good approach for this type of patient. However, more experiments are needed to verify the effectiveness of the mental imagination. In addition, this type of rehabilitation program requires that patients have sufficient cognitive ability to cooperate [37].

Other approaches

Other treatments have also been used, such as caloric stimulation, done by irrigation with water at different temperatures in the external auditory canal [38], or the use of eye slides or hemi-space glasses [39]. Studies involving these resources fail to demonstrate efficacy and its applicability in ADL. A recent study found that the association of conventional treatment with ocular movement stimulation did not provide a greater reduction of negligent symptoms than a conventional hemiplegia rehabilitation treatment [40].

Prism lenses

Another therapeutic modality studied, with positive results, uses prism lenses [41]. Besides the immediate effects, some authors support the idea that the effects of this approach are long lasting [42]. Corroborating with these studies, some review articles [43,44] also point to the positive effects of this therapeutic modality in the rehabilitation of hemineglect. Proponents of this technique believe that their main advantage is not to rely on a voluntary orientation of attention. The prisms cause an optical deviation of the visual field to the right, making objects appear to the right of what they really are, and so the patients can perceive them. After repeated exposure, patients begin to correct their trajectories in order to reach the objects.

Visual scanning

Training with scanning is based on the finding that hemineglect patients fail to explore the hemolampus contralateral to the cortical lesion, and are generally more focused and oriented towards non-negligent hemostasis. This training aims to increase attention to the negligible hemiespace; the cues generated by the therapist, for correction of the scanning, and later by the patient itself, help to increase the attention directed to the negligible hemicampo. Typically, the scanning training involves the patient's perception of lights reflected in a picture: patients have to systematically search for the lights, going from left to right with the help of verbal and visual clues to direct attention to the left margin of the frame7. A study using this technique [45] has shown that training with visual scanning reduces neglect and improves patient performance in reading and writing tasks. In this study, the training was developed for one month and had a total duration of twenty hours. The task was started when the patient found a yellow line (visual lane) that was placed at the left end of the frame. When the patient found the clue, the task continued with the appearance of lights in the frame that appeared from right to left. When the task was performed satisfactorily, it was transferred to reading and writing activities. There was no generalization of this improvement to other activities. In a randomized, controlled study [46] done by the same authors, others were incorporated into the previously described task where the patient had to identify which side of the back was touched and estimate the length of certain rods.

Patients submitted to the training obtained a significant improvement, when compared to patients in the control group, in specific tests for heminegency performed before and after treatment. In addition, this improvement was generalized for midpoint estimation tasks (different from those that were trained). In this same study, patients with more severe problems also showed more important improvement. Unfortunately, an evolutionary follow-up was not performed to see how long these benefits were maintained. Calvanio., *et al*. [47] made a careful review and concluded that the success obtained in the cited study was explained by some factors: specific training that focused on a single cognitive impairment (neglect); active patient participation; and intensive training (4 - 5 hours per week). They also concluded that generalization occurred effectively in tasks that were similar to those trained.

Another study compared visuospatial training with a general cognitive treatment, with a much greater improvement in the battery of tests for neglect in the group submitted to visual training [48]. From this point on, the group that received the conventional cognitive intervention was also submitted to treatment with visual scanning, again with good results. In an interesting study and possibly the most relevant outcome for functional activities, Wiart., *et al*. [49] combined visual scanning techniques with trunk rotation (patients had to turn their torso to the left when they were scanning to target objects with a rod that was stuck in his back). Whenever patients performed the tasks successfully, they received visual and auditory feedback, which made them benefit from multimodal attention stimuli during the exploration of neglected hemispace. This study was done in a controlled and randomized manner, demonstrating a significant improvement in the specific tests and in the ADL, measured by the Functional Independence measure (FIM). However, the equipment required for this type of training is complex (since it includes a computer adapted to the specific tasks, a table in which lights are lit according to the order of the computer and that causes the rod attached to the patient to vibrate when the target is hit) which could limit its clinical applicability; in addition, the follow-up period of the patients was only one month and only two patients were in the chronic stage of heminelect.

"Visual Scanning" x " Mental Practice"

In a study published by the authors of this article together with other contributors, we get through a more simple protocol than that the one suggested by Wiart., *et al*. and therefore more likely of being applied in the clinical practice, to demonstrate the efficacy of visual scanning when compared to mental practice, including the improvement of the symptoms for the daily life activities, besides demonstrating that the results remain for a long time after the end of intervention. Thus. we obtained differing results from previous studies such as those of the authors [50].

Robertson., *et al*. [51], who found no difference among patients who received training with a visual scanning program and a control group, and of Wagenaar., *et al*. [52], who concluded that visual scanning training improved the actual visual scanning behavior of the hemineglect patient, but without transferring of this improvement to the activity of navigation with wheelchair.

Thus, we agree with other review articles [53], which consider visual scanning a treatment with a strong scientific background.

Moreover, it is important to note that in a recent systematic review [54], only our visual scanning study and another one compared two treatment methods for heminelect, demonstrating the lack of studies comparing interventions for this type of sequel.

Conclusion

The techniques described here represent what we find most relevant in terms of rehabilitation of the patient with hemineglígence and can be used isolated or in combination, but the individuality of each patient should be taken into account.

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