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SHORT COMMUNICATION

FACIAL PARESIS AFTER STROKE AND ITS IMPACT ON PATIENTS' FACIAL MOVEMENT AND MENTAL STATUS

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Objective: **The aims of this study were: (*i*) to monitor changes in central facial paresis in patients with stroke after orofacial therapy, using functional scales and video analysis of the face; and (*ii*) to investigate correlations between changes in facial movement and mental function of patients after stroke.**

Methods: **A prospective blind randomized study of patients after stroke with facial paresis. The functional status of the experimental group of 50 cases treated with regulation orofacial therapy was compared with 49 control cases after 4 weeks of rehabilitation.**

Results: **There were changes in facial movement, evaluated with the House-Brackmann Grading System (HBDS), clinical range and two-dimensional video analysis of the distance between the paretic corner of the mouth and earlobe at rest and during smiling, were measured. Facial movement was found to be significantly better in the experimental group after orofacial therapy compared with the control group. Changes in mental status (depression observed using the Beck Depression Inventory (BDI-II) were significantly greater in the experimental group. There was a close correlation between the changes in facial movement and mental status according to Spearman's correlation coefficient.**

Conclusion: **Orofacial therapy has a significant effect after 4 weeks of treatment on facial movement and mental state in patients with stroke. Based on the results in our study we can say that the improvements are a significantly better in the experimental group (Difference value) in the parameters HBGS, distance between the corner of the mouth and earlobe and BDI-II.**

Key words: central facial paresis; stroke; orofacial rehabilitation.

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INTRODUCTION

Facial (n. VII) paresis is one of the most common disorders in patients after stroke, and is reflected by changes in facial movement. Stroke is defined as rapidly developing focal or global symptoms of brain function disorder that last for more than 24 h or might result in the death of the patient, without an apparent cause other than vascular origin (1).

Facial movement is one of the functions of the human nonverbal communication system. It serves not only to maintain the facial expression, but also plays an important role in speech, social communication, eating, singing, and eye protection.

Facial muscles can alter the facial surface in various ways to execute their functions. In addition to opening and closing the eyes and mouth they also have a reporting function. Highly differentiated and complex facial musculature can express a large number of sensations and can reflect the state of mind and mood of an individual.

Paresis of the facial nerve after stroke causes functional and aesthetic defects, manifested by facial asymmetry with muscle impairment of the lower half of the face, drooping of the corner of the mouth, dribbling from the corner of the mouth, asymmetrical smile and a speech explicitness disorder with atonia of the lips, tongue and throat (1, 2).

The present study evaluated this impairment of facial movement and symmetry qualitatively and quantify. Neurological facial examination involved an examination of the function of the facial nerve. A diagnosis of central or peripheral paresis of the facial nerve was made on the basis of a clinical examination. A standard international clinical scale, the House-Brackmann Grading System (HBGS) (3–5), was used to quantify n. VII paresis (paresis of *nervus facialis*).

Changes in facial movement may also result from other symptoms, including the psychological state of the patient, and vice-versa. Therefore, most cases of facial movement failure might be due to psychological consequences. Many patients experienced anxiety and depression after stroke. One of the causes of depression can be change in the face following facial paresis. After stroke, 50–60% of patients experience depression within 3 months (6–9). Patients with depression after stroke have a worse prognosis. Deterioration in the quality of life is demonstrated, with increasing motor movement disability in normal daily activities. Patients have worse rehabilitative care effect, a longer period of hospitalization and are less often able to return to the home environment (6, 8, 10). The Beck Depression Inventory (BDI-II) test was used quantitatively to evaluate the burden of depression (10–12).

In the "central type" of n. VII paresis the aim of orofacial therapy is to relax spastic muscles, restore selective functions of the orofacial muscles and re-educate fundamental facial movement and communication (verbal and non-verbal) features, and functions during eating.

The aim of this study was to evaluate the impact of central *n. VII* paresis in patients after stroke on functions of facial movement and on depression, using clinical scales and the objective measurement of facial movement changes by two-dimensional (2D) video analysis (13–15).

METHODS

The study included 99 patients in the subacute stage of a stroke (1–2 weeks after onset). Patients began rehabilitation on the second day after stroke. Initially, they were in the "stroke unit" (Intensive Care Unit (ICU), Neurology Clinic, Hospital in Olomouc) and after transfer rehabilitation continued at the Department of Rehabilitation and Exercise Medicine, University Hospital in Olomouc. The inclusion criterion for the study was central n. VII paresis after stroke. The exclusion criterion was lack of cooperation.

At the beginning of rehabilitation, patients were divided into two comparable groups; experimental and control groups. Distribution was random and blinded by 2-colour cards. Each patient took one card out of the box. If the card was blue, the patient was assigned to the experimental group. If the card was green, the patient was assigned to the control group.

The experimental group comprised 50 subjects, of whom 26 were males with an mean age of 57 years and 24 females with an mean age of 62 years. The types of stroke were: 38 (76%) ischaemia and 12 (24%) haemorrhagic; lesion side: 32 (64%) right-sided hemiparesis and 18 (36%) left-sided hemiparesis; level of severity: mean value 12 (standard deviation (SD) 2) according to the National Institutes of Health stroke scale (NIHSS).

The control group comprised 49 subjects; 27 males with an mean age of 60 years and 22 females with an mean age of 61.5 years. The types of stroke were: 39 (79%) ischaemia and 10 (31%) haemorrhagic; lesion side: 29 (59%) right-sided hemiparesis and 20 (41%) left-sided hemiparesis; level of severity: mean value 13 (SD 1) according to NIHSS.

In both groups all patients were treated with selective serotonin reuptake inhibitors (SSRI) class antidepressants (citalopram 10 or 20 mg/day) at the effective prophylactic or therapeutic dose recommended by the psychiatrist.

In both groups speech therapy was provided once a day, focusing on the treatment of communication disorders, and rehabilitation exercises were scheduled twice a day, aiming at the reconstruction of damaged physical functions of the trunk, arms and legs. In addition, targeted physiotherapy orofacial treatment was provided once a day in the experimental group, including rehabilitation of myofascial structures of the face, breathing rehabilitation and targeted facilitation of facial functions using the elements of orofacial regulation therapy, which seeks to recreate physiological function by applying pressure, touch, vibration and traction to specific points on the face, thus activating the orofacial muscles (16).

Clinical evaluation was carried out at the beginning of therapy and after 4 weeks of therapy. Facial movement was assessed using the HBGS standardized clinical questionnaire (3) and by device measurement with 2D video analysis, which measured the distance of control points between the paretic corner of the mouth and the earlobe (13, 15). Depression was evaluated according to the BDI-II (11). The assessors in the study were blinded.

Basic statistics (arithmetic mean and SD) were calculated for individual parameters. The data were verified statistically using single-factor analysis of variance for repeated measures, with statistical significance set at $p < 0.05$. As a subsequent *post-hoc* test the Fischer least significant difference test was used to compare individual groups in repeated measurements. The correlation of facial movement changes with depression was tested using Spearman's correlation coefficient at $p < 0.001$.

RESULTS

There was a substantial improvement in functions of facial movement in both groups. Improvement in facial movement, as measured with the HBGS, of two or more degrees was observed after 4 weeks in 31 cases (62%), and of one degree in 18 cases (36%). The condition remained unaltered in one case (2%), and there was no deterioration in the experimental group. In the control group, there was a spontaneous improvement of two degrees or more in two cases (4%), a slight improvement in one degree, in 20 cases (40.8%), and no change in 28 cases (55.2%).

A significant difference in the mean values on the HBGS before and after rehabilitation of 1.66 (SD 0.55) was observed in the experimental group and of 0.59 (SD 0.57) in the control group (Table I). There were significant difference in the changes in distances between the corner of the mouth and the earlobe in the experimental group (11.5 mm (SD 3.50)) and in the control group (2.0 mm (SD 2.30)) (Table I).

Statistically significant improvements in the experimental group can also be seen in the evaluation of depression according to the BDI-II (Table I). There was a significant difference in the mean values of the BDI-II before and after rehabilitation in the experimental group (14.3 (SD 5.1)) and in the control group (6.9 (SD 5.1)). In the experimental group 45 cases (90%) showed reduced depression, in 5 cases (10%) it remained unchanged, and no cases showed an impaired condition. In the control group we observed improvement in 29 cases (60%), in 20 cases (40%) the condition remained unchanged, and no cases showed an impaired condition.

Table I. *Mean values before and after rehabilitation in the experimental and control groups*

	Before		After		Difference	
	Group 1 Mean (SD)	Group 2 Mean (SD)	Group 1 Mean (SD)	Group 2 Mean (SD)	Group 1 Mean (SD)	Group 2 Mean (SD)
HBGS	3.74 (0.63)	3.69 (0.65)	2.08 (0.63)	3.10 (0.71)	1.66 (0.55)	0.55 (0.57)
DIS	66.0 (4.0)	64.0 (4.0)	55.0 (4.0)	62.0 (3.7)	11.5 (3.5)	2.0 (2.3)
BDI-II	35.7 (5.7)	34.9 (6.3)	21.4 (4.2)	28.0 (6.3)	14.3 (4.5)	6.9 (5.1)

SD: standard deviation; HBGS: House-Brackmann Grading System (score values); DIS: distance between corner of the mouth and earlobe in mm assessed by two-dimensional video analysis at maximal voluntary mouth pouting; BDI-II: Beck Depression Inventory (score values).

A close relationship, with a positive Spearman's correlation coefficient value of 0.69 ($p < 0.001$), was found in the correlation of changes in facial movement and depression.

DISCUSSION

This study demonstrated significant positive results in patients with central n. VII paresis after stroke who were treated with targeted orofacial rehabilitation. Similar results were obtained by Svensson et al. (17) in their study comparing the effect of mimic electromyography (EMG) biofeedback in 23 patients after stroke with a control group of 12 patients without EMG mimic therapy. They observed the recovery of facial functions after one month in both groups, and there was normal facial function or only mild dysfunction after 6 months in two-thirds of patients. Patients with right-sided facial impairment showed significantly better results than patients with left-sided facial impairment.

However, in their study, Svensson et al. (17) measured the same functional state of facial movement (according to HBGS), sensitivity and awareness of facial asymmetry in both experimental and control groups 6 months post-stroke. These authors therefore do not recommend the use of mimic EMG biofeedback therapy in patients after stroke with n. VII paresis. They predict spontaneous remission of central n. VII paresis. It should be noted that this study was conducted on a relatively small group of patients and the results did not reach statistical significance. In comparison with Svensson et al. (17), our study involved a sufficiently large group of patients and the results were statistically significant, confirming the positive effects of orofacial physiotherapy for treatment of central paresis after stroke.

In assessing depression after stroke using the BDI-II, significant improvement was measured in the experimental group as well as in the control group. Depression after stroke (post-stroke depression; PSD) occurs in 40–60% of patients (6–9). Patients with depression after stroke have a significantly poorer self-sufficiency prognosis, worse rehabilitation effect, worse quality of life, longer hospitalization period, and impaired ability to return to the home environment (6, 7, 10). Women have greater difficulty accepting the facial change and orofacial rehabilitation, which plays an important role (9, 10). Mikulik (9) and Svensson et al. (17) suggested that, in a small number of patients, there is spontaneous alteration in facial movement and PSD remission without treatment (9, 17). In studies by Roth et al. (7) and Rima et al. (6), however, better modification of cognitive function and neurological deficit, including central paresis of the facial nerve in patients with PSD, were associated with treatment with antidepressants and psychotherapy. Based on the results in our study we can say that the improvements are a significantly better in the experimental group (Difference value) in the parameters HBGS, distance between the corner of the mouth and earlobe and BDI-II.

Our study confirmed the positive effects on orofacial function, facial movement and depression in patients with central n. VII paresis after stroke who, in addition to physiotherapy and speech therapy, received 4 weeks of targeted orofacial therapy.

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