Int. Adv. Otol. 2010; 6:(1) 39-45

ORIGINAL ARTICLE

Selective Rehabilitation of Posttraumatic Facial Palsy: The Influence of Previous Operation and Timing

Stankovic Ivona, Milisavljevic Dusan, Djordjevic Gordana, Dimitrijevic Lidija, Colovic Hristina

Clinic for physical therapy and rehabilitation, Clinical center Nis, Serbia, (SI, DL, CH)
Clinic for otorhinolaryngology, Clinical center Nis, Serbia, (MD)
Clinic for neurology, Clinical center Nis, Serbia, (DG)

Objective: Patients with posttraumatic facial palsy are not homogenous when neuromuscular dysfunction is analyzed and nonselective therapy causes unequal improvement after physical therapy.

Study design: Prospective review of patient's records.

Setting: Tertiary referral center.

Materials and Methods: In order to verify the effects of physical therapy of posttraumatic facial palsy according to the degree of dysfunction, a prospective study on 24 patients was performed by dividing them into four groups: altered initiation of movement, difficulty with facilitation, difficulty with movement control and difficulty with relaxation. Seven patients were previously operated, and the others were treated medicamentously.

Interventions: Selective therapy of facial palsy included application of physical procedures and training of facial musculature.

Main Outcome Measures: Facial Grading System (FGS) and Facial disability index (FDI) were used for evaluation of treatment.

Results: Selective therapy of posttraumatic facial palsy resulted in improvement of all the parameters. The rate of improvement was comparable in FGS and FDI scale. Spontaneous facial nerve recovery showed lower values of improvement for both scales. Significant improvement of selective therapy appeared mostly after 30 days of treatment. Previously operated patients had lower improvement rate. Early selective physical therapy for posttraumatic facial palsy produced significantly better final outcome.

Conclusion: Selective and individual approach to physical therapy of posttraumatic facial palsy can have important therapeutical influence on the final outcome. The type and degree of neuromuscular dysfunction must be used for selection of physical therapy.

Submitted : 05 September 2009 *Revised : 06 December 2009* *Accepted : 12 December 2009*

Introduction

Among different factors that can cause peripheral facial palsy trauma is particularly important. Neuromuscular dysfunction of facial nerve after trauma can affect motor neurons and axons, facial muscles, as well as central neural connections. The manifestations of dysfunction are: difficulty in starting the movement (initiation), difficulty in control of regularity of movement or relaxation because of involuntary contractions. The patients with facial palsy have problems with nutrition, drinking, speech, and anxiety in social situations caused by facial disfigurement.[1-4]

Facial nerve rehabilitation includes massage, electrical stimulation, and exercise of facial muscles with unequal results. Reeducation of facial neuromuscular system with electromyography, or visual control of facial musculature gave good results. Facial neuromuscular reeducation is a process of training of facial musculature that aims at increasing muscular function and at preventing irregular muscular activity. The program of this practice must be individual for

Corresponding address:
Prof. Ivona Stankovic,
Clinic for Physical Therapy and Rehabilitation, Clinical Center Nis,
Medical Faculty, University of Nis Bul. Z. Djindjica 48, 18 000 Nis, Serbia,
Phone: +381 18 520 595; E-mail: ivona@medfak.ni.ac.rs

each patient based on the degree of facial neuromuscular damage, symptoms and clinical signs. [5, 6-10] The treatment of facial palsy is mainly based on facial appearance at rest, voluntary movements, abnormal contractions during voluntary movements, irregular spontaneous activity and other disturbances in daily life caused by facial weakness. [5, 7]

On the other side, there are not sufficient data concerning the positive effect of selective facial reeducation depending on different groups of patients, especially in traumatic cases. This emphasizes the need to define more precisely the types of facial deficit and to adjust the therapeutical approach.

The aim of this study was to analyse:

1. the effect of individual selective physical therapy of posttraumatic peripheral facial palsy,
2. the influence of degree of facial nerve damage,
3. the effect of early physical therapy on the outcome.

Material and Methods

This prospective study included 24 patients with posttraumatic facial palsy that were medically treated. The patients were older than 18 years, with residual facial weakness. Most of the parients were previously treated with corticosteroids and vitamins [17], whilst a smaller part was previously operated (5 patients with nerve decompression, and 2 with neurosuture). The decision to perform operation was based on the intensity of trauma, judged by clinical appearance, CT findings, and degree of degeneration at electromyography. Absence of facial movements and advanced neural degeneration without improvement after one month were indications for decompression. Neurosuture was performed immediately in two cases with temporal bone fracture.

The patients were all divided into four groups:

a) difficulty with initiation of movement (9 patients),
b) difficulty during movement (facilitation) (6 patients),
c) difficulty with control of movement (6 patients),
d) difficulty with relaxation after movement (3 patients).

This classification was based on history, facial appearance at rest without visible movements, palpation of face and determination of reduction of movement.

The patients with difficult initiation of facial movement suffer from droping of food and liquid from their mouth and dry eyes. Difficult facilitation of movement is manifested by the same symptoms, but with smaller intensity. Difficulty of movement control is characterised by eye closure during eating and laughing, lacrimation during lip movement, drooling during talking, chin biting during eating, with gradual worsening of symptoms. Relaxation problem is present with facial tension, repeated eye closure, difficulty with opening the eye, reading, watching television, drinking, writing, driving the car (Table 1).

Study of movement and facial status included appearance at rest and during movements, and presence of spasms and other changes. The patients were asked to perform certain facial movement, to relax, and to repeat movement. The presence and intensity of movement and synkinesis were judged and compared to the healthy side. Palpation was made at rest in order to determine muscular spasm.

Control group included 8 patients with posttraumatic facial palsy, but without physical therapy during the same observation period. The patients both in control and analysed group received only corticosteroid treatment initially 1mg/kg, tapering the dose up to one month.

Physical therapy was applied according to protocol listed in Table 1 Within the initiation group the treatment included actively assisted range of motion exercises for a specific movement of facial muscles. For facilitation group symmetrical active and resisted facial movement exercises were performed. Movement control difficulties were treated by focusing on controlling the abnormal or synkinetic movement with increase of range of movement. Relaxation group was instructed to perform relaxation exercises with progressive contraction and relaxation of specific facial muscles. The exercises were conducted in front of mirror to provide a sensory feedback and promote learning.[7]

Table 1. Symptoms, signs and therapy of different groups of posttraumatic facial palsy

GROUP	SIGNS/SYMPTOMS	THERAPY
Initiation	• Depressed eyelid, eyebrow, chin, and lip at rest, • Inability or minimal ability to start movement, incomplete closure of eye, • Marked physical impairment and psychosocial problems.	Active assisted range of motion, control of movement, small range, education on recovery process.
Facilitation	• Minimal or absent facial drooping at rest, • Weak or moderate facial weakness, complete eye closure, • Problems of physical function bigger than psychosocial.	Active range of motion, practise of limitation of movement.
Control of movement	• Eyelids narrowed, retracted nasolabial fold, moved angle of mouth and phyltrum, tension at rest, • Slight to moderate facial weakness; abnormal movents with voluntary movements, • Physical function less affected than psichosocial.	Isolated movements, correction of movements, stretching exercise.
Relaxation	• Increased facial tension at rest, • Spontaneous ticks and spasm that increase with voluntary attempt, • Little or no change in physical function, marked psychosocial difficulties.	Ritmical movements, relaxation and stretching exercise.

The results of therapy were analysed every 15 days, for two months total observation time.

Facial Grading System (FGS) is a questionaire filled by examiner according to: position of eye, nasolabial groove, angle of mouth at rest (FGS at rest), as well as according to position of opened mouth, voluntary movements, forehead wrinkling, closing the eye, laughing with opened mouth, pucking the lips (FGS during movements), and presence of synkinesis during voluntary movements. Obtained values for the first group were multiplied by five, and for the second group by four. The values for the first group were 0-20, and for the second 0-15. Total grade could amount 0-100, and was calculated using formula: Total FGS = FGS during movements - FGS at rest - FGS synkinesis. [11, 12]

Facial disability index (FDI) specific for facial palsy with physical and social scale was also used.[7, 10]

Paired t test was used to investigate the differences between groups (p value less than 0.05 denoted the presence of a statistically significant difference).

Results

Average age of the patients was 41.7 years, without statistical significance between the groups. The period from development of facial palsy and onset of selective treatment of patients was different, beeing on average 12.4 days for initiation group, 17.3 days for facilitation group, 27.7 days for movement control, and 29.3 days for relaxation group.

Both Facial Grading System (FGS) and Facial disability Index (FDI) scale indicated higher pretreatment valus for operated group of patients. In the group with difficult initiation of movement the bigger change of FGS was found at rest and during movement, and the smallest values for synkinesis. On the other side, movement control and relaxation groups were characterized by a better FGS at rest and during movement, but high synkinesis score. Facilitation group had values between the previously mentioned ones. (Table 2).

Selective therapy resulted in improvement of all the parameters in all the studied groups. Statistical significance of improvement was not reached only for synkinesis in Initiation and Facilitation groups. The same was found for Physical scale for movement control and relaxation groups. The rate of improvement was comparable in FGS and FDI scale. The biggest effect of selective therapy was confirmed for initiation and facilitation groups. (Table 3). Control group showed lower values of improvement for both scales.

Table 2. Values of Facial Grading System (FGS) and Facial Disability Index (FDI) scale before and after therapy of posttraumatic facial palsy.

SCALE		INITIATION		FACILITATION		MOVEMENT CONTROL		RELAXATION	
		Before	After	Before	After	Before	After	Before	After
OPERATED	FGS Rest	16.8 ± 6.3	10.6 ± 4.1 *	18.3 ± 5.5	8.3 ± 3.1 *	15.3 ± 5.1	9.8 ± 5.2 *	12.7 ± 6.6	7.7± 3.3 *
	FGS Movement	24.6 ± 8.3	51.4 ± 9.2 *	51.2 ± 10.3	58.3 ± 8.2 *	49.3 ± 6.9	56.6 ± 9.2 *	61.2 ± 10.3	5.2 ±10.6
	FGS Sinkinesis	2.3 ± 0.4	1.9 ± 0.6	2.1 ± 0.8	1.4 ± 0.5	9.2 ± 2.3	5.7 ± 2.2 *	10.2 ± 3.1	7.3 ± 4.2 *
	FDI Physical	23.6 ± 9.3	51.3 ± 12.6*	41.0 ± 9.7	56.6 ± 12.3*	49.7 ± 14.2	52.2 ± 15.5	46.2 ± 12.5	52.3±14.2
	FDI Social	43.7 ± 5.9	57.3 ± 9.5 *	53.2 ± 10.4	63.7 ± 9.2 *	43.5 ± 13.3	48.6 ± 12.2	39.7 ± 8.5	50.7 ± 9.7 *
NON OPERATED	FGS Rest	15.3 ± 6.1	5.6 ± 4.3 *	12.2 ± 3.6	4.2 ± 2.7 *	8.3 ± 4.2	5.6 ± 3.9 *	6.4 ± 4.1	5.3 ± 3.2 *
	FGS Movement	30.6 ± 8.9	75.8 ± 11.3*	57.9 ± 8.1	75.4 ± 6.9 *	51.3 ± 7.6	77.3 ± 9.6 *	66.5 ± 10.4	79.2±12.4*
	FGS Sinkinesis	0.9 ± 0.5	0.7 ± 0.3	1.1 ± 0.3	0.6 ±0.3	5.3 ± 0.9	3.0 ± 0.7 *	6.2 ± 1.3	4.2 ± 0.9 *
	FDI Physical	47.3 ± 8.5	77.8 ± 11.3*	65.3 ± 7.6	77.5 ± 8.9 *	61.5 ± 9.2	79.5 ± 10.5	64.4 ± 4.1	76.3 ± 8.4
	FDI Social	57.2 ± 11.3	74.3 ± 9.6 *	67.9 ± 8.3	78.3 ± 12.3*	55.8 ± 10.2	76.2 ± 12.2*	66.5 ± 10.4	78.4 ± 9.3 *

**= significantly different (p<0.05)*

Table 3. Values of Facial Grading System (FGS) and Facial Disability Index (FDI) scale with and without therapy of posttraumatic facial palsy at the end of study.

SCALE		INITIATION		FACILITATION		MOVEMENT CONTROL		RELAXATION	
		Control	Therapy	Control	Therapy	Control	Therapy	Control	Therapy
OPERATED	FGS Rest	12.2 ± 8.7	10.6 ± 4.1	10.8 ± 5.2	8.3 ± 3.1	10.5 ± 6.8	9.8 ± 5.2 *	12.3 ± 5.8	7.7 ± 3.3 *
	FGS Movement	36.2 ± 8.7	51.4 ± 9.2 *	56.2 ± 7.9	58.3 ± 8.2	51.8 ± 9.5	56.6 ± 9.2	63.2 ± 9.4	65.2 ±10.6
	FGS Sinkinesis	2.2 ± 0.8	1.9 ± 0.6	2.6 ± 0.7	1.4 ± 0.5 *	8.5 ± 3.1	5.7 ± 2.2	9.1 ± 4.6	7.3 ± 4.2
	FDI Physical	39.3 ± 10.8	51.3 ± 12.6*	45.2 ± 11.6	56.6 ± 12.3*	44.7 ± 12.5	52.2 ± 15.5	52.2 ± 11.3	52.3 ± 14.2
	FDI Social	52.7 ± 7.2	57.3 ± 9.5	57.2 ± 8.7	63.7 ± 9.2*	46.1 ± 10.3	48.6 ± 12.2	38.2 ± 9.1	50.7 ± 9.7 *
NON OPERATED	FGS Rest	7.8 ± 5.1	5.6 ± 4.3	7.9 ± 4.7	4.2 ± 2.7 *	7.3 ± 3.9	5.6 ± 3.9	6.1 ± 3.8	5.3 ± 3.2
	FGS Movement	61.1 ± 9.5	75.8 ± 11.3*	63.2 ± 9.7	75.4 ± 6.9*	56.3 ± 8.7	77.3 ± 9.6*	69.5 ± 9.4	79.2 ± 12.4
	FGS Sinkinesis	3.1 ± 0.4	0.7 ± 0.3 *	2.1 ± 0.5	0.6 ±0.3 *	4.7 ± 0.8	3.0 ± 0.7*	5.2 ± 0.6 *	4.2 ± 0.9
	FDI Physical	68.5 ± 5.5	77.8 ± 11.3*	72.4.3 ± 8.5	77.5 ± 8.9	65.4 ± 8.3	79.5 ± 10.5*	69.5 ± 6.1	76.3 ± 8.4
	FDI Social	69.4 ± 11.5	74.3 ± 9.6 *	73.2 ± 7.1	78.3 ± 12.3	63.1 ± 9.5	76.2 ± 12.2*	68.1 ± 9.2	78.4 ± 9.3 *

**= significantly different (p<0.05)*

Time course of selective therapy indicated that significant improvement appears mostly after 30 days of treatment, and it is maintained throughout the analyzed period, for all the groups, except for Facilitation group. Previously operated patients had consistently lower improvement, up to 60 days of observation, except for synkinesis in Initiation and Facilitation groups (Figure 1 and 2).

Early selective physical therapy of posttraumatic facial palsy (starting up to 30 days from its onset) gave significantly better final outcome, except for relaxation group. The improvement was more evident when using FGS scale (Figure 3).

Discussion

Different grading systems are used for analysing facial nerve function. For clinical grading of voluntary movement, there is good correlation between ratings given by the House-Brackmann, Sydney and Sunnybrook systems, and within each system there is good reliability. [13-15] The movement, rest, secondary defects, and subjective scoring grading system is more useful for grading facial nerve dysfunction in clinical practice than the House-Brackmann Grading Scale. [16] New modifications of grading systems are currently proposed. [17]

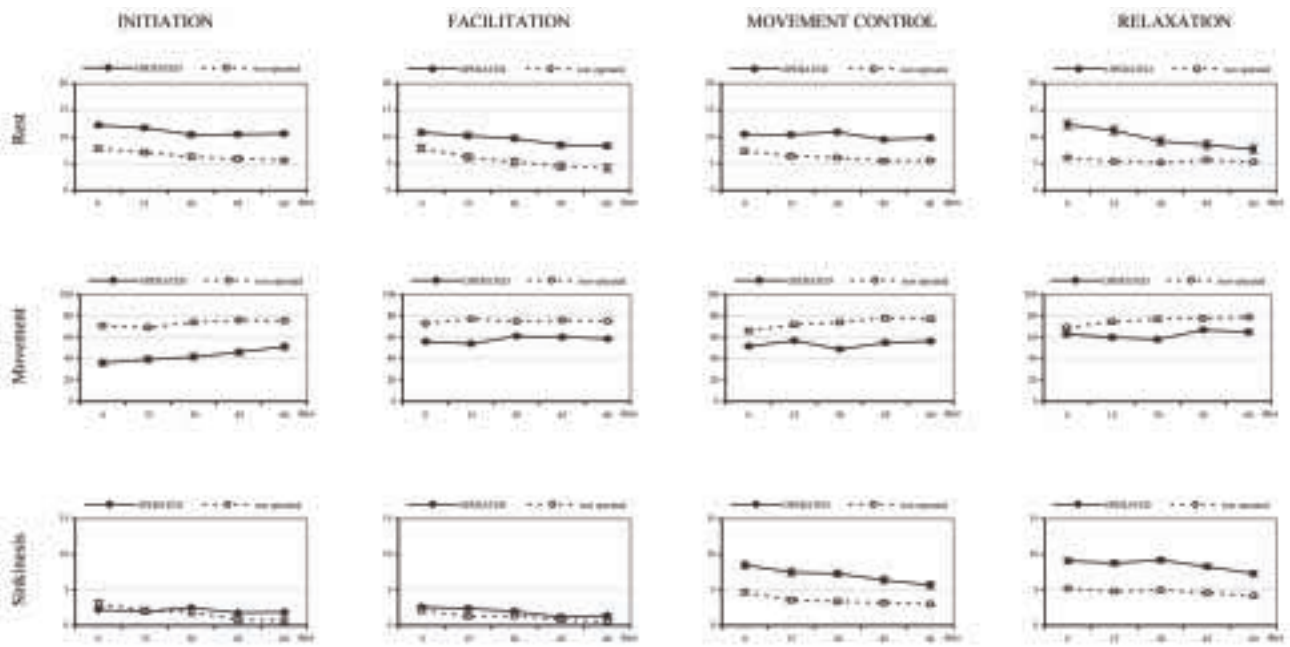

Figure 1. The influence of previous operation of posttraumatic facial palsy on improvement of values of Facial Grading System (FGS) scale.

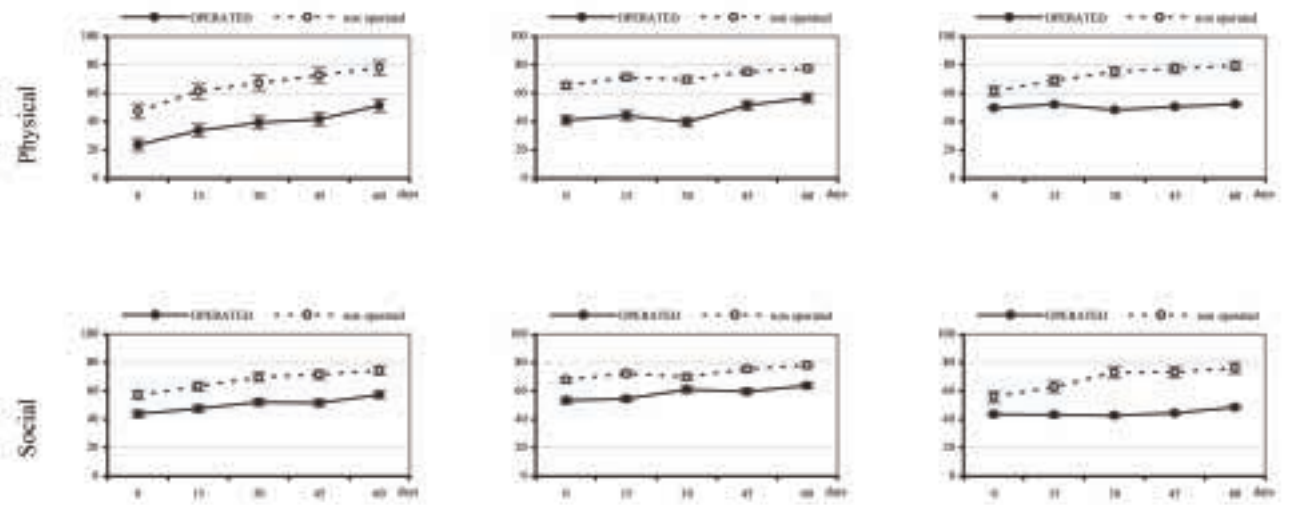

Figure 2. The influence of previous operation of posttraumatic facial palsy on improvement of values of Facial Disability Index (FDI) scale.

VanSwearingen and Brach[11] proposed classification of disability of facial neuromuscular system in order to adjust the treatment of these changes. The rationale was to optimise the treatment for different types of altered facial function and neuromuscular status, irrespectively to etiologic factor.

Patients able to activate only a small group of facial muscles have limited number of functional neumuscular connections and passive positioning of face gives good results in this group. Patients with incomplete voluntary facial function and small, but yet present movements have improvement after training for increased facial activity. Repeated activation of motor programs enhances previously learnt movements. Patients with synkinesis (irregular facial movements present with voluntary movements) have

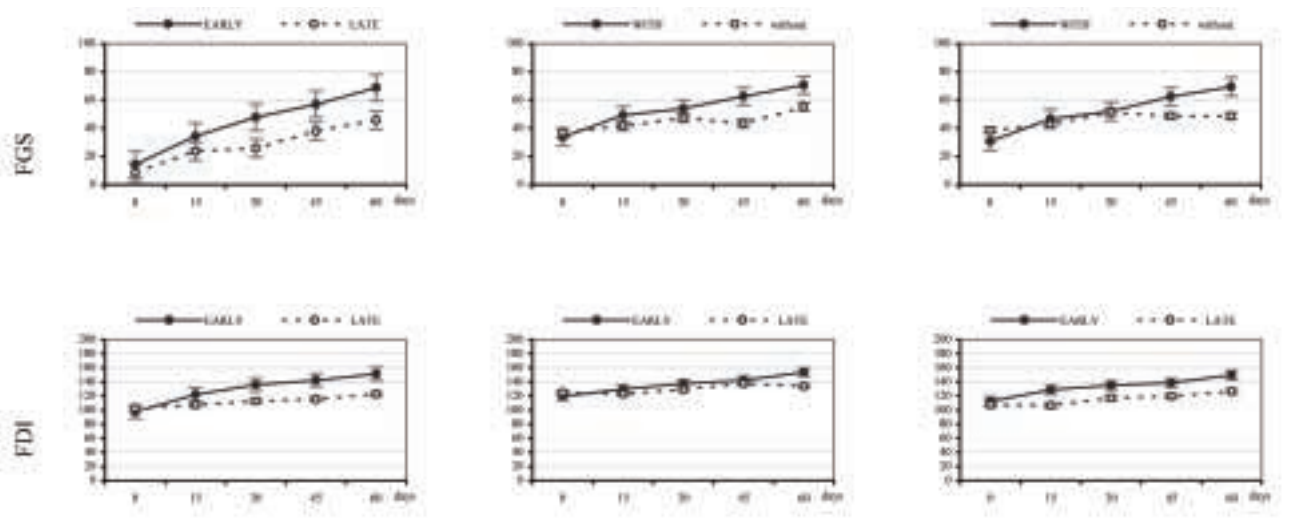

Figure 3. The influence of early therapy of medicamentously treated traumatic facial palsy on improvement of total values of Facial Grading System.

increased ratio of recruited nerve fibers. Muscular dysfunction is manifested by atypical activation during voluntary movement with inclusion of other fibers. Functional improvement can be achieved by adequate reduction of irregular movements comprising of inhibition of synkinesis, isolation of muscles for certain movement and limitation of activity up to the level of regularity. Patients with abnormal, spontaneous muscular activity irrespectively to voluntary movement (spasm and tick) have improvement after use of interventions to increase muscular relaxation. [5-11]

Different values of alteration of facial function investigated with FGS and FDI reflect the course and degree of nerve damage. Earlier onset of investigation is characterized by bigger changes at rest and during movement, while synkinesis is absent. Later on, as spontaneous recovery develops, motor function is improved, but synkinesis becomes bigger problem, as confirmed in movement control and relaxation group.

In this investigation more intense changes for parameters on FGS and FDI scale for previously operated posttraumatic peripheral facial palsy were found because of more significant neuromuscular damage in these patients. Therefore, physical therapy is of bigger clinical value for such patients.

The values of FGS and FDI scale in this study are comparable to the results of Van Svearingen and Brach.[11] These data indicate that the development of therapeutical protocol based on the symptoms snd signs of facial damage with classification into groups of different neuromuscular damage is valuable for adequate therapy and for control of its effects.

Facial retraining is an excellent example of the plasticity of the central nervous system to reorganize, even in cases of longstanding paralysis. Current therapeutical protocols of facial palsy were not sufficiently oriented to the differences in muscular activity, what can be the cause of limitted success of physical therapy of peripheral facial palsy in some cases. Adequate therapy can improve facial activity, and thus facial function in daily activity and psychosocial activities.[18-22]

Conclusion

Selective physical therapy of posttraumatic facial palsy resulted in improvement of all the parameters in all the studied groups. Statistical significance of improvement was not reached only for synkinesis in initiation and facilitation groups. The same was found for Physical scale for movement control and relaxation groups. The rate of improvement was comparable in FGS and FDI scale.

Significant improvement of selective therapy appeared mostly after 30 days of treatment. Previously operated patients had lower improvement rate, except for

synkinesis in initiation and facilitation groups. Early selective physical therapy of posttraumatic facial palsy caused significantly better final outcome, except for relaxation group.

The results from this study indicate that selective therapy of posttraumatic facial palsy results in improvement of all the parameters in all the studied groups. Reduction of synkinesis and improvement of rest status, and facial movements were found together with better physical and social scale values in all the groups of facial alterations.

References

1. Moffat D: Tests of Facial Nerve Function, in Ludman H, Wright T: Diseases of the Ear, Arnold, 1998, 245-255.

2. Bleicher JN, Hamiel S, Gengler JS, Antimarino J: A Survey of Facial Paralysis: Etiology and Incidence. Ear Nose Throat J. 1996; 75:355-358.

3. Brandel P, Saloretti-Schefer S, Bohmer A, Wichmann W, Fisch U: Correlation of MRI, Clinical and Electroneurographic Findings in Acute Facial Nerve Palsy. Am J Otol. 1996; 17:154-161.

4. Vilela DS, Lazarini PR, Da Silva CF. Effects of hyperbaric oxygen therapy on facial nerve regeneration. Acta Otolaryngol. 2008; 128:1048-52.

5. Henkelmann TC, May M: Physical therapy and meuromuscular rehabilitation, in May M: The Facial Nerve, Thieme, New York, 2000; 301-313.

6. Frijters E, Hofer SO, Mureau MA. Long-term subjective and objective outcome after primary repair of traumatic facial nerve injuries. Ann Plast Surg 2008; 61:181-7.

7. VanSwearingen JM, Brach JS: The facial disability index; reliability and validity of a disability assesment instrument for disorders of the facial neuromuscular system. Physical Therapy 1996; 76:1288-1299.

8. Ross BG, Fradet G, Nedzelski JM: Development of a Sensitive Clinical Facial Grading System. Otolaryngol Head Neck Surg. 1996; 114:380-386.

9. Engstrom M, Jonsson L, Grindlund M, Stalberg E: House-Brackmann and Yanagihara Grading Scores in Relation to Electroneurographic results in the Time Course of Bell's palsy. Acta Otolaryngol (Stockh) 1998; 118:783-789.

10. Lal D, et al. Electrical stimulation facilitates rat facial nerve recovery from a crush injury. Otolaryngol Head and neck Surg 2008; 139:68-73.

11. Ross BG, Fradet G, Nedzelski JM. Development of sensitive clinical facial grading system. Otolaryngol Head Neck Surg 1996; 114:380-386.

12. Frijters E, Hofer SO, et al. Long-term subjective and objective outcome after primary repair of traumatic facial nerve injuries. Ann Plast Surg. 2008; 61:181-7.

13. Coulson SE, Croxson GR, et al. Reliability of the "Sydney," "Sunnybrook," and "House Brackmann" facial grading systems to assess voluntary movement and synkinesis after facial nerve paralysis. Otolaryngol Head Neck Surg 2005; 132:543-9.

14. Lin V, Jacobson M, et al. Global assessment of outcomes after varying reinnervation techniques for patients with facial paralysis subsequent to acoustic neuroma excision. Otol Neurotol. 2009; 30:408-13.

15. On AY, Yaltirik HP, et al. Agreement between clinical and electromyographic assessments during the course of peripheric facial paralysis. Clin Rehabil 2007; 21:344-50.

16. Husseman J, Mehta RP. Management of synkinesis. Facial Plast Surg 2008; 24:242-9.

17. de Ru JA, Braunius WW, et al. Grading facial nerve function: why a new grading system, the MoReSS, should be proposed. Otol Neurotol 2006; 27:1030-6.

18. Cronin GW, Steenerson RL: The effectiveness of neuromuscular facial retraining combined with electromyography in facial paralysis rehabilitation. Otolaryngol Head Neck Surg 2003; 128:534-8.

19. Manikandan N: Effect of facial neuromuscular re-education on facial symmetry in patients with Bell's palsy: a randomized controlled trial. Clin Rehabil 2007; 21:338-43.

20. Cederwall E, Olsén MF, Hanner P, Fogdestam I: Evaluation of a physiotherapeutic treatment intervention in "Bell's" facial palsy. Physiother Theory Pract 2006; 22:43-52.

21. Özgirgin ON, Özlüoğlu L: Facial nerve injuries revisited. Mediterr. J Otol 2006; 3:127-132.

22. Ozgirgin ON, Cenjor C, Filipo R, et al: Consensus on treatment algorithms for traumatic and iatrogenic facial paralysis. Mediterr. J Otol 2007; 3:(3) 150-159.