Original Article

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Effect of electromyographic biofeedback therapy for idiopathic facial palsy

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ABSTRACT

An investigation was made of the comparison between the effect of biofeedback therapy versus low frequency electrical stimulation on 31 patients with idiopathic facial palsy.

There were no significant differences in the nerve conduction latency and amplitude before or after the treatment between the two modalities. However, the difference in the score for facial movement and integrated electromyogram value showed a statistical significance.

The change in the effect of the two groups before and after treatment was the same. In a post-treatment comparison there were no significant difference in the latency and amplitude between the two groups. However, a difference in the score for facial movement and integrated electromyogram showed a statistical significance. Furthemore, the score for facial movement showed a sharp gradient in treatment effect during the recovery, but the score for integrated electromyogram only a gentle gradient the score of treatment.

In conclusion, a maximum recovery of the neuromuscular function was brought about by electromyographic biofeedback therapy.

KEY WORDS

electromyographic biofeedback therapy, idiopathic facial palsy

INTRODUCTION

Electromyographic biofeedback has been suggested for facilitation, coordination, control, retraining and strengthening of various neuromuscular disorders. Evidence of the effectiveness of electromyograph (EMG) feedback traning in neuromuscular reeducation was presented by Marincci.[1] The present case study by Jankel[2] and Booker[3] investigated the efficacy of feedback in restoring muscle control to facial muscles which had been affected by Bell's palsy. With visual/or auditory monitoring of muscular contractions, both patient and therapist receive immediate objective assesment of the functioning of the muscles.[4] Basmajian has also written extensively on the applicability of EMG feedback procedures in training either single motor units or groups of units. He tested th effectiveness of biofeedback training compare coventional physical therapy in the treatment of para lytic foot-drop. But these evidence are unclear b control cases and case report.[6,7,8] The purpose o the present study was to investigate the efficacy o EMG feedback procedure in restoring muscle contro to facial muscles which had been affected by idio pathic facial palsy and the effectiveness of EM feedback training was compared to low frequenc electrical stimulation training.

MATERIALS AND METHODS

Thirty-one patients with idiopathic facial palsy pa ticipated in this study. All subjects were n

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Fig 1. Information through the biometer is audiovisually feedback

Table 1. Characteristics of Group A and Group B Patients

	Group A (n=16)	Group B (n=15)	P-value
Age (in years)	46.6±18.8	45.5±26.1	NS
Time since onset (days)	22.5±13.3	25.2±18.0	NS
Treatment duration (days)	39.9±23.3	45.5±26.1	NS

neurotmesis. The subjects were randomly divided into two groups. Group A consisted of sixteen subjects who recieved EMG feedback therapy (Fig 1) and group B consisted of fifteen subjects who received low frequency electrical stimulation (Table 1). The group A was 46.6±18.8 years old and Group B was 49.1±17.0 years old. There was no significant difference between two groups in the age. From the crisis to the rehabilitation treatment commencing time was 22.5±13.3 days in the group A and was 25.2±18.0 days in the group B. The duration of therapy in each group were 39.9±23.3 days and 45.5±26.1 days. Group A and B in this treatment commencing time and duration of therapy showed no a significant difference. And there was no difference in the otorhinolaryngotogical treatment between both groups.

EMG biofeedback therapy was designed for muscle contraction by audiovisual EMG feedback device using Minato Medical Company's bio-meter. The subjects were not instructed to contract the paralyzed muscles. The surface electrode was fixed to the skin over the orbicularis oris muscle bilaterally. The muscles of the group B were stimulated with 10Hz, 30~40V electric current. All subjects received treatment twenty minutes per a day, five times a week. The subjects without induction nerve potential were exclued from the study.

Prior to the first and after the 1 week, 3 week, treatment session of each patient, facial movement score was performed to assess motor performance. And in same time, compound muscle action potential, facial nerve latency and electromyography (EMG) was evaluated.

RESULT

The subjects in the both groups showed changes in facial movement score after the treatment. In group A the increase was greater as that in group B. Before the treatment, with the group A, in the comparison of the group B, it did not consider significant, but after the treatment, the high score of the group A was shown. There was a significant correlation between group A and B (Table 2). In the amplitude of nerve evoked potential before and after treatment, there was no significant correlation between group A and B (Table 3). In facial nerve latency before and after

Table 2. Facial Movement Score

	Group A		Group B	
	before	after	before	after
Score	14.1±5.1	27.2±8.1	10.1±7.0	18.7±11.0
P-value	P<0.01		P<0.01	
	Before		After	
	Group A	Group B	Group A	Group B
Score	14.1±5.1	10.1±7.0	27.2±8.1	18.7±11.0
P-value	NS		P<0.01	

Table 3. Nerve Conduction Amplitude

	Group A		Group B	
	before	after	before	after
Amplitude(first seg.)	422.7±254.6	580.7±352.8	496.0±354.3	627.2±468.4
P-value	NS		NS	
Amplitude(third seg.)	290.0±132.4	486.4±225.9	361.3±150.8	411.0±189.3
P-value	NS		NS	
	Before		After	
	Group A	Group B	Group A	Group B
Amplitude(first seg.)	422.7±254.6	496.0±354.3	580.7±352.8	627.2±468.4
P-value	NS		NS	
Amplitude(third seg.)	290.0±132.4	361.3±150.8	486.4±225.9	411.0±189.3
P-value	NS		NS	

(μV)

Table 4. Nerve Conduction Latency

	Group A		Group B	
	before	after	before	after
Latency(first seg.)	3.3±0.7	3.1±0.4	3.3±0.7	3.1±0.8
P-value	NS		NS	
Latency(third seg.)	3.9±0.8	3.7±0.8	3.8±0.7	3.7±0.7
P-value	NS		NS	
	Before		After	
	Group A	Group B	Group A	Group B
Amplitude(first seg.)	3.3±0.7	3.3±0.7	3.1±0.4	3.1±0.8
P-value	NS		NS	
Amplitude(third seg.)	3.9±0.8	3.8±0.7	3.7±0.8	3.7±0.7
P-value	NS		NS	

(msec)

Table 5. EMG integrated values

	Group A		Group B	
	before	after	before	after
value(levator)	108.1±56.4	210.6±95.3	79.1±32.5	100.3±48.3
P-value	P<0.01		P<0.05	
value(depression)	87.2±63.5	163.7±68.5	55.9±32.4	81.3±45.8
P-value	P<0.01		P<0.01	

	Before		After	
	Group A	Group B	Group A	Group B
value(levator)	108.1±56.4	79.1±32.5	210.6±95.3	100.3±48.3
P-value	NS		NS	
value(depression)	87.2±63.5	55.9±32.4	163.7±68.5	81.3±45.8
P-value	NS		P<0.01	

(μV.sec)

Table 6. Effect of Group A and B, Before and After Treatment

	Group A Before : After	Group B Before : After	Before A : B	After A : B
Amplitude(first seg.)	NS	NS	NS	NS
Amplitude(third seg.)	NS	NS	NS	NS
Latency(first seg.)	NS	NS	NS	NS
Latency(third seg.)	NS	NS	NS	NS
Movement score	P<0.01	P<0.01	NS	P<0.05
Integrated Value(levator)	P<0.01	P<0.05	NS	P<0.01
Integrated Value(depression)	P<0.01	P<0.01	NS	P<0.01

treatment, there was no significant correlation between group A and B (Table 4). In the myoelectricity integrated value, both groups were significantly increased after the treatment. Before treatment there was no significant correlation between group A and B, but after treatment there was a significant correlation between group A and B (Table 5).

DISCUSSION

There are great numbers of papers which described the therapy effect of EMG biofeedback[9]. But these papers are only descriptions of dramatically obtaining the therapy effect. In some papers, these are small numbers of the case and the control is not described. There is no description on the mechanism of the effect and science of EMG biofeedback therapy on these papers.

Then, we chose the cases using the patient with idiopathic facial paralysis without the degeneration in the facia nerve and the mechanism of the therapy effect of the EMG biofeedback were estimated. To use the case without the degeneration in the facial nerve is from next reasons. It has been confirmed to perfectly cure in about 40th which is averaged from the pathopoiesis, even if it is not done, even if the treatment is carried out using the low frequency electric stimulation in such case.[10] The low frequency stimulation was used that is a control of the therapy effect of EMG feedback.

In therapy effect comparison as the result of EMG feedback group and low frequency electric stimulation group in the before and after therapy, there was a significant difference at facial movement score and EMG integrated value. There was no change at nerve

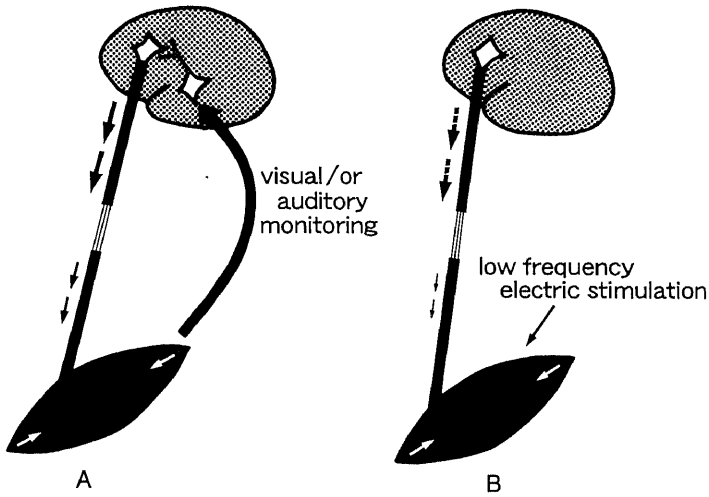

Fig 2. A schematic illustration of the mechanizm of action between biofeedback treatment and electrical stimulation.

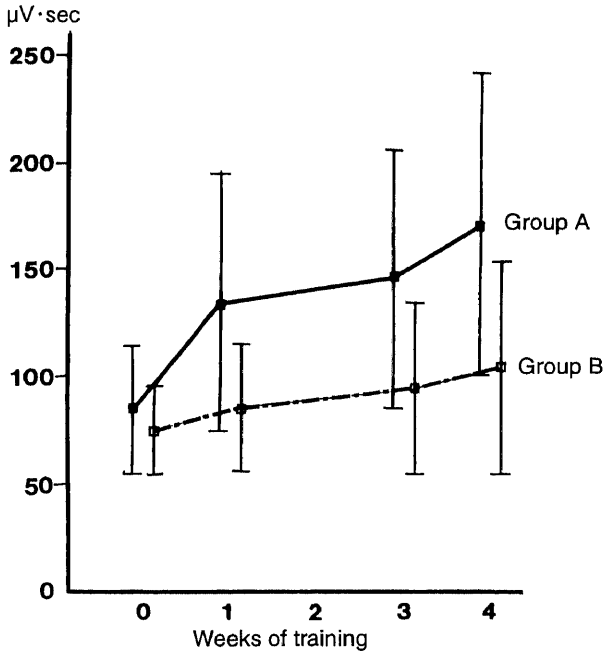

Fig 3. Temporal change in the integrated EMG values for the biofeedback (A) and electrical stimulation (B) groups.

conduction velocity and amplitude. But, there was no significant difference in both group before therapy. There was a significant difference in facial movement score and EMG integreted value after the treatment for both groups. However, the difference was not in both groups at nerve conduction velocity and amplitude. When it was summarized (Table 6), the significant difference was recognized in EMG integrated value and facial movement score, though EMG feedback group and low frequency stimulation group not recognized the difference in nerve conduction velocity and amplitude. It was far effective for the EMG feedback therapy, even if natural recovery was deducted. The EMG feedback does not affect directly to the recovery of damaged nerve and muscle itself. It was concluded that the moving itself of paralyzed face was activated. Basmajiyan reports that EMG feedback was used for drop foot with the stroke patient during several months or years and dramatic effect eas obtained. The nerve pathway concerning the impro-

vement on such remarkable movement control is not clear. But there are two possibilities. Though the possibility is low, it is the theory that the new conduction path was produced. The second theory[5] is that cerebrum and spinal cord circuit which have originally remained began to work by the introduction of the artificial feedback circuit. As regarding of Fig 2, the load of EMG feedback which depends on peripheral nerve and muscle increases than that of the low frequency stimulation. The EMG feedback works in all of the voluntary movement of remaining nerve and muscle. It is because that the EMG feedback group is significantly bigger than low frequency stimulation group at face movement score and EMG integrated value after the treatment. In addition, the difference is not recognized in nerve evoked potential in both group. And the therapy effect of EMG feedback is largest for muscle integrated value in the first week (Fig 3). It is considered that the feedback therapy recovered nerve and muscle itself in this short period. The biofeedback therapy draws largest the ability in which nerve and muscle remained.

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筋電図バイオフィードバック療法の硬化
－特発性顔面神経麻痺に対する治療－

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要　　旨

筋電バイオフィードバック療法の効果を知る目的で，特発性顔面神経麻痺患者31名を用い，コントロールとして低周波刺激治療と比較検討した。神経誘発電位では，治療前と治療後とで両者共に差はないが，顔面運動評価および筋電積分値で有意に効果を認めた。筋電バイオフィードバック療法と低周波刺激治療との比較で，治療前では差を認めないものの，治療後では神経誘発電位では差をみないが，顔面運動評価および筋電積分値では有意に差を認め，更に前者では１週で急激な勾配でもって効果を見るものの，後者では当初より緩やかな勾配をもって治癒していった。筋電バイオフィードバックは神経・筋の残存能力を最大に引き出す効果があることが判明した。