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Factors affecting the effect of physical rehabilitation therapy for synkinesis as a sequela to facial nerve palsy

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ABSTRACT

Objective: To investigate factors affecting the effect of physical rehabilitation therapy for synkinesis as a sequela to facial nerve palsy.
Methods: A total of 37 patients with peripheral facial nerve palsy in Teine-Keijinkai Hospital were enrolled in this study. All patients showed synkinesis at 6 months after the onset of facial nerve palsy and were instructed in physical rehabilitation by expert staff from their first visit. The degree of synkinesis was evaluated at 6, 9 and 12 months after the onset of facial nerve palsy based on Sunnybrook facial grading system score and asymmetry in eye opening width. The patients were divided into two groups by age, gender, cause of palsy, electroneurography (ENoG) value, onset of synkinesis, initial treatment and timing of the start of physical rehabilitation.
Results: Female patients and younger patients did not show any deterioration in synkinesis. Patients in the lower ENoG group and the later onset of synkinesis group showed significant deterioration in synkinesis after the 6th month from onset of facial palsy.
Conclusion: Physical rehabilitation was shown to prevent significant deterioration in synkinesis in female and younger patients with facial nerve palsy. Careful follow-up with regard to synkinesis is required in cases in which the facial nerve damage is thought to be severe.

1. Introduction

Synkinesis is one of the most uncomfortable sequelae to facial nerve palsy and reduces the patients' quality of life. It presents as an abnormal involuntary facial movement such as eye closure during smiling or mouth movement during blinking. Misdirection of facial nerve axons during regeneration is thought to be one of the main causes of synkinesis [1,2]. Although the treatment for synkinesis is challenging, physical rehabilitation for synkinesis including biofeedback using a mirror or electromyography has been reported to be effect [3–5]. We have reported deterioration in synkinesis from the 6th month after the onset of facial nerve palsy without physical rehabilitation by expert staff [6]. In our previous study, we instructed patients not to contract their facial muscles strongly and to massage their facial muscles by hand; however, no biofeedback rehabilitation by expert staff was carried out. In this study, we investigated whether we could prevent the deterioration in synkinesis by physical rehabilitation including mirror biofeedback and massage. In addition, we searched for factors affecting the effect of physical rehabilitation therapy for synkinesis as a sequela to facial nerve palsy.

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2. Materials and methods

A total of 37 patients with peripheral facial nerve palsy in Teine-Keijinkai Hospital (15 with Bell's palsy and 22 with Ramsay Hunt syndrome including zoster sine herpete) who showed some degree of synkinesis at 6 months after the onset of facial nerve palsy were enrolled in this study. Patients who received initial therapy (i.e., steroid and/or anti-viral therapy) in other hospitals prior to referral to Teine-Keijinkai Hospital for the purpose of physical rehabilitation were also included. Our standard treatment strategy for facial nerve palsy is as follows. In patients with Bell's palsy who visited our hospital within 3 days from the onset, valacyclovir was administered at 3000 mg/day for 2–5 days (depending on the severity of the paralysis) in combination with prednisolone at 1 mg/kg/day for 5 days. Patients who visited our hospital after 4 days from the onset were treated with prednisolone alone. Patients with Ramsay Hunt syndrome were treated by combination therapy with prednisolone (1 mg/kg/day) and an anti-viral agent (acyclovir at 750 mg/day by drip infusion or valacyclovir at 3000 mg/day). Of the 37 patients enrolled in this study, 27 were treated by combination therapy with steroids and an anti-viral agent, 6 were treated by steroids alone, 1 was treated by an anti-viral agent alone and 1 was treated by vitamin B12 alone. There were 2 patients for whom the initial treatment was unknown. No patients in this study received surgical decompression. Patients who did not permit the video-recording of their facial movements and who were not observed for at least 1 year were excluded. Fifteen patients were male and 22 were female, with a median age of 57 years (range, 28–79 years). Synkinesis was evaluated by visual assessment, with informed consent obtained from each patient. The evaluation of sequelae was performed as described previously [6]. In brief, facial movements were recorded by video camera at 6, 9 and 12 months after the onset of palsy. In our previous study, only two time points (i.e., the 6th and 12th month after the onset of facial nerve palsy) were investigated. To examine the time course of synkinesis more precisely, evaluation at 9th month after onset was added. Our investigation consisted of [1] scoring using the Sunnybrook facial grading system, and [2] computing the asymmetry (%) in eye opening width. The Sunnybrook facial grading system assesses the face at rest and during voluntary movement, taking into account the range of movement as well as the presence of synkinesis [3]. Asymmetry in eye opening width was calculated for 3 mouth movements (baring one's teeth, pursing one's lip and puffing one's cheeks) from still images [4]. Several consecutive still images were compared and the image with the narrowest eye opening width on the affected side during mouth movement was chosen for evaluation of the asymmetry eye opening width. In one case, the data for only two time points (the 6th and 12th month) were analyzed due to insufficient data. The examiner viewed three videotapes for each patient in a randomly set order and was not told which videotape was recorded at 6, 9 and 12 months after onset. The examiner was not involved in either the initial treatment or physical rehabilitation. To investigate which factors influence the effects of physical rehabilitation, the patients were divided into two groups by age, gender, cause of palsy, electroneurography (ENoG) value, onset of synkinesis, initial treatment and timing of the start of physical rehabilitation. Wilcoxon signed-rank test was used to examine statistical significance ($p < 0.05$). This research adhered to the tenets of the Declaration of Helsinki.

2.1. Physical rehabilitation by expert staff

Physical rehabilitation by expert staff was begun at the first visit to Teine-Keijinkai Hospital. The expert staff mentioned here are qualified speech therapists who have attended the workshop on facial physical rehabilitation held by the Japan Society of Facial Nerve Research. Four speech therapists were involved over the study period, and all had adequate clinical experience. Of the 37 patients, 23 patients visited within 1 week after the onset of facial nerve palsy, whereas the remaining 14 patients began physical rehabilitation as follows: 4 patients started physical rehabilitation in the 1st month, 2 in the 2nd month, 5 in the 4th month and 3 in the 7th month after the onset of facial nerve palsy. Physical rehabilitation consisted of the application of hot packs, massage and stretching by hand, mirror biofeedback and eyelid motion using the *levator palpebrae superioris* muscle. A handout with information regarding the physical rehabilitation was distributed to all patients. The core physical rehabilitation was based on the following: the purpose of the hot packs was to improve blood flow to the face and patients were recommended to put hot packs on the affected side of their faces for about 10 min two or three times per day. The directions for facial massaging and stretching were given as a handout with photographs. Patients were prescribed 30 min of daily home training and recommended to avoid strong contractions of the facial muscles during the course of the rehabilitation. Mirror biofeedback was started when the first sign of muscle contraction in the affected side was observed. Patients were instructed to try to keep their eyes open during the 2 mouth movements (lip pursing and teeth baring) by biofeedback using a mirror three times per day. The importance of eye protection was also emphasized. The patients were instructed on physical rehabilitation for 40 min once or twice per month by the expert staff. The degree of sequelae was also evaluated and compliance with at-home physical rehabilitation confirmed.

3. Results

Fig. 1 shows the changes in voluntary movement (A) and synkinesis (B) scores on the Sunnybrook facial grading system as well as a comparison of the asymmetry in eye opening width (C–E) for the 37 patients at 6, 9 and 12 months. Both voluntary movement scores and synkinesis scores showed significant increases between the 6th and 12th month ($p < 0.05$). The asymmetry in eye opening width during baring one's teeth and puffing one's cheeks both decreased significantly ($p < 0.05$). Although there were no significant differences, the asymmetry in eye opening width showed a slight improvement between the 9th and 12th months (Fig. 1C–E).

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