

Initial experience in the use of Functional Electrical Stimulation in a variety of neurological conditions resulting in facial palsy

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Abstract

Facial palsy may result from Bell's palsy, poliomyelitis, CVA, trauma, otitis media or tumour. Whatever the cause there remain a significant number of patients who suffer considerably, both physically and psychologically. The traditional treatment for such patients has been surgery and a number of different muscle and nerve transfer procedures exist. Despite these there are some patients unwilling to undergo surgery, particularly if they have some limited function. Even those who do undergo surgery often do not fully regain normal volitional control.

Fifteen years ago there were a number of studies investigating the effect of electrical stimulation on the recovery of facial palsies, concentrating primarily on those due to Bell's palsy using a pattern of electrical stimulation known as eutrophic stimulation. Despite this there are today few clinical services and a review of the literature showed that this field is receiving little attention. Salisbury provides specialist plastic surgery services for 3 million people in southern England and as such uses a number of surgical techniques to treat facial palsy. In order to improve the outcome of surgery 10 patients over the past eighteen months have been seen and treated using electrical stimulation. The reason for the facial palsy has been mixed and all patients seen have had chronic conditions, the longest a facial palsy due to poliomyelitis fifty years ago.

The results obtained have been encouraging with some patients, including the polio case, able to initiate voluntary control and improve facial symmetry. However, although able to initiate movement the muscles fatigue rapidly, making it impossible to sustain facial expressions. It is

The use of electrical stimulation to treat facial paralysis has not been widely used, however a few papers using a variety of stimulation regimes have been published over the past few years (3,4,5). The greatest interest occurred in the mid 1980's

postulated from our other research, that in order to overcome this limitation the period of electrical stimulation per day has to be significantly increased, possibly stimulating during sleep. The results will be presented as a series of case studies.

Introduction

There are a number of different causes for facial paralysis the mostly common of which is Bell's Palsy, however it can also be caused by otitis media, trauma, CVA, surgery, tumour or of congenital origin (1). Bell's Palsy alone affects between 0.16 and 0.25 per 1000 in Britain each year. The majority of these, 80%, recover spontaneously over a period of 6-12 weeks, nevertheless some remain affected. Whatever the cause there are a significant number of patients who manifest with the devastating stigmata of the condition. (2) There are a variety of treatments for this condition which include; surgical decompression, steroids etc. Once conditions have become chronic a variety of plastic surgery procedures are available to improve symmetry. Surgery can consist of static or dynamic procedures. Static procedures, which are designed to improve the symmetry of the face at rest include canthoplasties to restore position of the lower eyelid and static facial slings to support the corner of the mouth. Dynamic procedures offer the chance for movement of the paralysed face and these can be divided into muscle transfers using the masseter and temporalis muscle to provide movement. More complicated procedures comprise of free microvascular transfers of muscles from elsewhere in the body into the face using microsurgical anastomosis of its blood vessels, motorised by a facial nerve graft from the non-paralysed side.

with the advent of eutrophic stimulation which used a pattern of stimulation based on that of EMG activity of the facial muscles. The stimulation intensity is not sufficient to cause muscular contraction, being up to 18v, 80 mS rectangular

monophasic pulses. In their trial (2), which was only in chronic cases, they found a significant improvement in the treatment group compared to the conventional therapy group. Despite these findings then authors know of no other groups who are using eutrophic stimulation today. No definitive explanation has been given as to how eutrophic stimulation works.

One of the problems in evaluating any treatment in Bell's Palsy in particular, is that the majority of people do get symptomatic improvement with time (6). Although this report was written in 1984 there is still considerable scepticism within the medical profession as to whether electrical stimulation has a role to play in the treatment of facial paralysis.

Methods

For this reason the only people we have are those with chronic conditions, referred to the Plastic Surgery Department in Salisbury for whom other treatments have failed. Sometimes these patients have already had surgery, whereas for other electrical stimulation is undertaken initially. All of the patients referred have had flaccid paralysis.

Stimulation is provided by a two channel microprocessor controlled stimulator producing 300mS balanced monophasic pulses at 10-40 pps, with an output of up to 120mA. Pals Plus 2 electrodes are used and are individually cut to suit each individual. The most commonly stimulated muscles are zygomaticus major, levator labii, levator labii superioris alequae nasi, levator anguli oris and frontalis.

Most people find the sensation of stimulating facial muscles to be painful and therefore care needs to be taken when adjusting the stimulation intensity. Prior to stimulation it is necessary to thoroughly clean the skin to remove any traces of cosmetics. It is often best to initially stimulate the unaffected side of the face as it enables the motor points to be determined and enables the clinician to determine the likely level of stimulation necessary to cause a contraction. Electrodes need to be small and are best placed close together so that the current path is superficial. If the current path is deeper nerves of the teeth may be activated which causes pain.

As the stimulation intensity is increased the patients face is carefully observed and the threshold levels needed to initial movement noted. Once it has been determined which muscles can be stimulated a training regime is determined for each patient. The patient is then shown how to use the stimulator and apply the electrodes and seen at regular intervals so that

their progress can be monitored. Digital photographs are taken both with and without stimulation at each assessment as well as with the patient trying to actively move their face. To facilitate record keeping a standard set of photographs are always taken.

Results

Patient 1 Age 60 facial paralysis due to polio at age 9years. Period of stimulation 18 months. Regained some voluntary control without stimulation but can not sustain facial expressions.

Patient 2 Age 56, facial paralysis following removal of brain tumour in 1995. Period of stimulation one year. Some movement now possible.

Patient 3 Age 23, congenital facial palsy. Period of stimulation 20 months. Good response with stimulation, some improvement in voluntary movement.

Patient 4 Age 7, congenial facial palsy. Just commenced treatment. Some movement with stimulation.

Patient 5 Age 44, Facial paralysis following RTA two years ago. Using stimulation for one year. Able to achieve movement with FES. Some improvement in voluntary function.

Patient 6 Age 41 years, facial paralysis due to acoustic neuroma three years ago, also has severe facial pain. Using stimulation for three months. Some increased facial movement with stimulation. Pain reduced when stimulation on.

Patient 7 Age 57, facial paralysis following surgery as a child. Using stimulation for 18 months. Some voluntary control, now symmetrical around eye and cheek, feels much more confident in social situations, skin condition improved.

Patient 8 Age 21, congenital facial palsy. Using stimulation for 6 months. Some improvement in voluntary control.

Patient 9 Age 65, Bell's Palsy two years ago. Using stimulation for 14 months. Some improved symmetry around the mouth. Improved response with stimulation but little improvement in voluntary control.

Patient 10 Age 54, CVA twelve months ago. Using stimulation for three months. Improved ability to open her eye. Improved control of mouth and nasal muscles.

Discussion

We realise that our experience in these techniques is limited, however we have been surprised by the results we have observed in some patients, especially subject 1 who had had a facial paralysis for 50 years after having polio as a child and subject 7 who had had facila paralysis for 35 years. Both of these subjects were pleased with the difference stimulation had made and both stated that they felt more confident in social situations.

Despite this limited success we realise that the treatment regime is not optimised. And more information is needed on the possible mechanism by which improvement occurs. It is apparent that all of these cases must be incomplete by the very fact that we were able to elicit a response using electrical stimulation with parameters such as those used here. To do this detailed neurophysiological assessment should be undertaken prior to commencing treatment and at regular intervals for as long as treatment is continued.

It was also apparent that none of the patients who were able to perform voluntary movement were able to make sustained contractions. It was felt that this might be expected due to the length of time that the patients had suffered from facial paralysis meant that any muscles that did remain would be very easily fatigued. As the daily time spent stimulating the muscles was comparatively short it would not be expected that there would be any change in muscle fibre type and hence improvement in fatigability. (7) To overcome this problem stimulation would need to be applied for considerably longer periods each day, possibly overnight. It is not felt to be practical to undertake this using surface electrodes and that percutaneous electrodes would appear to offer the best chance of success.

In conclusion we were surprised that some of these patients with symptoms lasting many years responded so well to electrical stimulation. We realise the limitations of the work to date but feel that this is an area worthy of further study, incorporating more detailed neurophysiological assessment and monitoring. It is hoped that by combining electrical stimulation with new techniques in plastic surgery that the physical and psychological symptoms that this group of patients suffer can be considerably reduced.

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