

Electroacupuncture: An introduction and its use for peripheral facial paralysis

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Abstract

Acupuncture and electrotherapy interface in the practice of electroacupuncture (EA). This article introduces some of the basic concepts and terminology of EA, its advantages and electrical parameters. The aetiology and incidence of peripheral facial paralysis (PFP), its pathology and prognosis are then covered. Conventional treatment of PFP is briefly mentioned, followed by a more detailed discussion of Western electrotherapy for the condition and the evidence for its clinical use. Background information on manual acupuncture (MA) and PFP is given. The literature on EA is reviewed, and EA treatment is then described according to the stage and severity of paralysis. Comparisons between EA and other modalities and combinations with ancillary methods are outlined, and the acupoints and electrical parameters used are analysed in some detail. A final discussion summarises some suggestions for safe and effective treatment.

This article is based on the chapter on peripheral motor disorders in the author's recently published textbook on electroacupuncture,¹ together with material from the clinical studies database at www.electroacupunctureknowledge.com and an internet trawl of recent research.

Note: This article is abridged due to space constraints. The full article at [www.jcm.co.uk/JCM Journal/Latest Issue](http://www.jcm.co.uk/JCM%20Journal/Latest%20Issue) includes a comprehensive table of facial muscles, nerves and corresponding acupuncture points and full references.

Electroacupuncture, electrotherapy and peripheral facial paralysis - the background

Electroacupuncture: an introduction

Acupuncture and electrotherapy interface in the practice of electroacupuncture (EA). Here this is defined as the electrical stimulation of acupuncture points (acupoints) through needles. After the needles are inserted and deqi obtained in the usual way, electricity is passed through pairs of needles to give a continued stimulation, usually for 20-30 minutes.

Related treatments include probe or point TENS (pTENS, electrical stimulation using a small diameter handheld probe) and transcutaneous electrical acupoint stimulation (TEAS, stimulation of acupoints via surface electrodes). Another approach is laser acupuncture (LA), the application of low intensity laser light to acupoints, either transcutaneously or through an inserted hollow needle. pTENS, TEAS and non-invasive LA are useful if patients find needles unacceptable, although their effects are not identical.

EA is applied at the same points as traditional or manual acupuncture (MA), and has been used for most conditions for which MA is indicated, especially when manual stimulation has not brought a response, or when strong reduction is appropriate (e.g. for severe or acute qi and/or blood stagnation). It is less commonly used in deficiency conditions.

Like other forms of electrotherapy, EA is particularly indicated for pain (as in painful obstruction [bi] syndrome), paralysis (both flaccid and spastic) and muscle wasting (as in atrophy disorder [wei syndrome]). It has beneficial effects on microcirculation, inflammation and nerve damage.¹

Advantages of EA include:

- EA is more effective than MA in some situations, and often potentiates the effects of traditional methods, particularly when strong, continued stimulation is required, as when treating paralysis or some forms of pain.²
- EA can be less time consuming and less demanding of the practitioner than MA, in both training and practice.
- Results may in some cases be more rapid,³ and longer lasting.⁴
- EA may have specific effects on pain, relaxation, circulation and muscle that are different from those of MA.⁵
- EA is more readily controlled, standardised and objectively measurable than MA.
- Non-invasive stimulation methods can also be cost effective for home treatments, perhaps between sessions with a practitioner, although some forms of treatment will require supervision.
- EA allows stronger, more continuous stimulation than MA,⁶ and with less tissue damage.

MA	EA
Needle manipulation is brief and intermittent Only 'low frequency' is possible (twirling or lifting-thrusting) Strong manipulation risks tissue damage	Stimulation is continued for the duration of treatment No limitation to frequency of stimulus (frequency-specific effects occur) Strength of stimulation only limited by patient tolerance

EA differs from MA in several respects (see table 1):

The parameters of EA

The electric current used in EA has various characteristics: polarity, frequency, amplitude/intensity, mode, pulse duration, waveform.

Polarity (and pulse duration)

Current should be biphasic (as in alternating current) rather than monophasic (as in direct current). In other words, current should flow one way and then the other way between the needles, rather than always the same way:

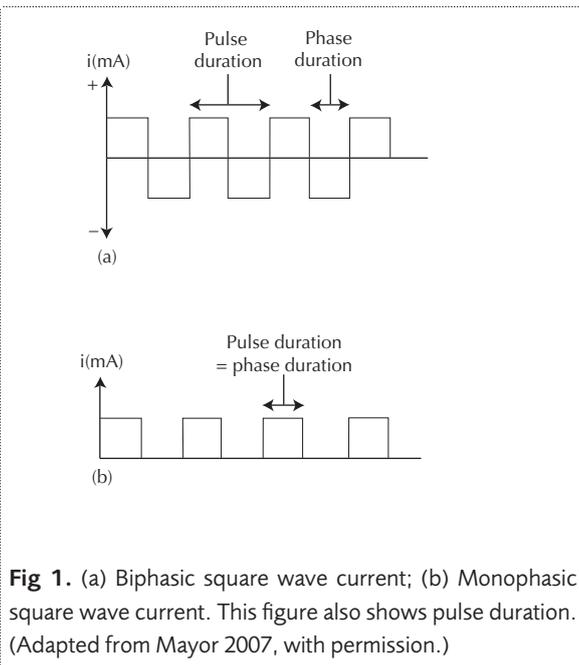


Fig 1. (a) Biphasic square wave current; (b) Monophasic square wave current. This figure also shows pulse duration. (Adapted from Mayor 2007, with permission.)

Frequency

Frequency (more accurately, the pulse repetition rate or number of pulses delivered per second) is measured in units of Hertz (Hz). In EA, a 'low frequency' (LF) would be approximately 2-4 Hz or pulses per second. A 'high frequency' (HF) would be 50-200 Hz.

Amplitude/intensity

Depending on the type of equipment used, amplitude may be a measure of current or voltage. In EA, maximum amplitude may be of the order of 12 mA (milliampères), or 9 V (volts), but these figures

will vary considerably depending on equipment design, and will take account of safety issues for the particular device in question. The strength of sensation experienced by the patient depends on amplitude more than on frequency. Sometimes the level of stimulation is described as 'sensory' (feelable), 'motor' (resulting in muscle twitching) or 'noxious' (frankly painful).

Mode

Stimulation may be continuous (CW) (as in Fig. 1a above), intermittent (burst), 'dense-disperse' (DD, alternating higher and lower frequencies), or otherwise modulated:

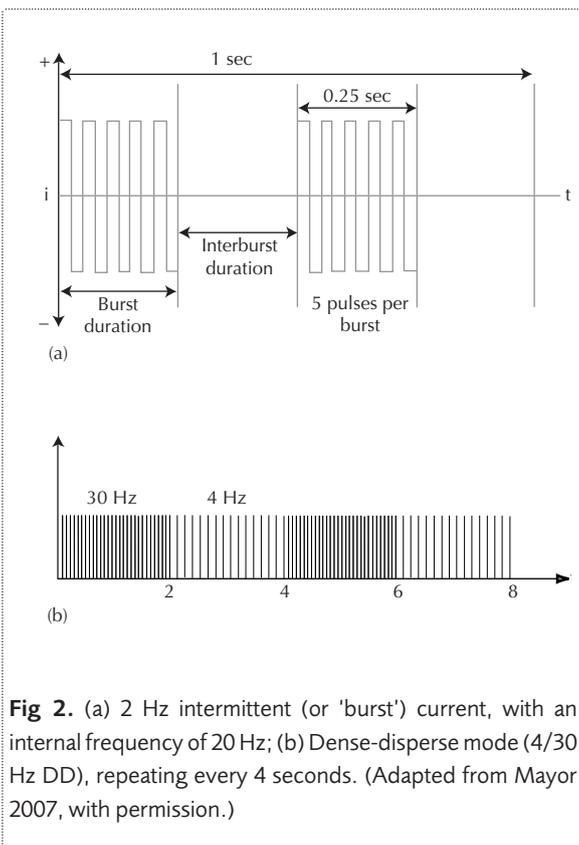


Fig 2. (a) 2 Hz intermittent (or 'burst') current, with an internal frequency of 20 Hz; (b) Dense-disperse mode (4/30 Hz DD), repeating every 4 seconds. (Adapted from Mayor 2007, with permission.)

Table 1: Some differences between MA and EA

Acupuncture-like stimulation (ALS) LF (high intensity)	TENS-like stimulation (TLS) HF (low intensity)
2-4 Hz	50-200 Hz
Pulse duration of around 200 μsec appropriate	Pulse duration of 80-100 sec optimum
May be used locally or distally (at extrasegmental or contralateral acupoints, for example)	Used locally (for instance at ipsilateral rather than contralateral points)
Has segmental and supraspinal neurophysiological effects	Has segmental effects (large diameter fibres inhibit pain signals in small diameter fibres in the spine)
Releases β -endorphin and Met- enkephalin neurotransmitters in the brain	Releases dynorphin in the spinal cord (and other peptides in the brain)
Strong stimulation elicits deqi-like sensation	High intensity may be uncomfortable
LF does not produce muscle spasm at high intensity (in normal muscle)	HF may result in uncomfortable tetany (but may also be useful for spasticity)
Intermittent pulse trains at high intensity may result in uncomfortable tetany	Intermittent pulse trains at low intensity enhance comfort
Central effects mean analgesia has slow onset and lasts longer – 30 minutes may suffice for ongoing effect (cumulative)	Spinal mechanism means analgesia has rapid onset and does not last long – longer periods of treatment may be necessary
No 'tolerance' develops from such short treatments	Tolerance may develop from longterm use
Tends to be used more for chronic pain	Tends to be used more for acute pain
For deep, aching, throbbing pain	For superficial pain associated with inflammation
May be helpful for neuralgia and other neuropathic pain (contralateral or distal)	May be helpful for neuralgia and other neuropathic pain (local)
	May benefit peripheral (sensory) nerve injury
May be used in hyperaesthesia (especially if cutaneous)	May aggravate hyperaesthesia
Used for flaccid paralysis (stroke, Bell's palsy)	Used for spasticity

(Based on Mayor 2007¹)

Table 2: Some differences between 'acupuncture-like' and 'TENS-like' stimulation

Waveform

We usually think of waves as curving, rolling, moving forms in nature. In EA, however, square (or rectangular) waves are mostly used, as illustrated here, although some EA devices produce spike or other waveforms.

Stimulation ranges

It is helpful to consider two main types of stimulation: low frequency (LF)/high intensity (subjectively strong, though still tolerable), and high frequency (HF)/low intensity (subjectively gentle and comfortable). Because of the way these were developed and researched – the former predominantly as EA in China and the latter predominantly as TENS (transcutaneous electrical nerve stimulation) in the West, I have called them

'acupuncture-like stimulation' (ALS) and 'TENS-like stimulation' (TLS), whether they are applied through needles or surface electrodes.

At around 15 Hz, a frequency between the LF and HF ranges, effects may depend on both mechanisms. There is still lack of agreement on whether frequency or intensity is more important in terms of outcome.

EA is frequently used in the treatment of peripheral facial paralysis. The discussion that follows illustrates some of the basic principles involved.

Cautionary note

Electroacupuncture, like any form of electrotherapy, should only be practised following proper instruction and with knowledge of its safety aspects.

Peripheral facial paralysis (PFP) (Bell's palsy, idiopathic facial paralysis)

Aetiology and incidence

Facial paralysis is the result of a motor neuron lesion. This may be peripheral (lower, below the nucleus of the nerve cell, or 'infranuclear') or central (upper, 'supranuclear').

Most cases (around 60-75%⁷) of peripheral facial paralysis (PFP) result from virally induced inflammation of the peripheral facial nerve (cranial nerve VII),⁸ or its compression due to vasospasm or oedema, generally in the mastoid region. Occasionally the condition is bilateral.⁹ It is particularly associated with herpes simplex or zoster infection, and may be precipitated by exposure to draughts on the face.¹⁰ An unpleasant variant is Ramsay Hunt's syndrome (herpes zoster oticus), in which paralysis is associated with a herpetic rash in or around the ear or on the roof of the mouth.¹¹ This condition also involves the acoustic nerve (cranial nerve VIII), which emerges from the brain just behind the facial nerve.¹²

The facial nerve may also be damaged by surgery for removal of an acoustic neuroma, or by trauma. In one standard physical therapy textbook, surgical damage was estimated to be responsible for 13% of cases of PFP, and other trauma for about 6%.¹³

As with any nerve injury, compression to the facial nerve results in neurapraxia (often spelled neuropraxia), a localised conduction block that recovers relatively quickly (within days or weeks) or, if more severe, in axonotmesis, degeneration of the nerve beyond the injury, with subsequent slow regrowth of the nerve (at an average of some 1 mm daily). Complete severance of the nerve, neurotmesis, may mean that it is highly unlikely to grow back to its target tissue.

PFP or Bell's palsy is not uncommon, with a reported incidence of 13-34 per 100,000 according to different epidemiological surveys,¹⁴ occurring most frequently between the ages of 20 and 40¹⁵ (although I had it myself as a teenager, after sitting in a draught after suffering chicken pox).

In some instances, the supranuclear pathway is involved as a result of cerebrovascular accident, with cortical or corticobulbar lesions, dissociation of voluntary and involuntary facial movements, and possibly other ipsilateral paralysis or aphasia. This can be differentiated from PFP by assessing the effects of magnetic stimulation of the cortex and facial nerve on the electromyogram (EMG) of the mentalis (chin) muscle.¹⁶ However, the possibility of simultaneous PFP and asymptomatic cerebral infarction should not be overlooked.¹⁷ Furthermore, as with sensory disorders and the development of chronic pain, when motor conditions become chronic the distinction between peripheral and central may be less clear as cortical reorganisation occurs.¹⁸ Treatment may need to take this into account, working with neuroplasticity within the central nervous system

as well as being directed at peripheral regeneration and repair.

Apart from stroke, Lyme disease, brain tumour and other possible causes such as multiple sclerosis and Guillain-Barré syndrome should be ruled out before treating as PSP.^{19,20,21}

Pathology and prognosis

Pain behind or in front of the ear may precede the paralysis, which affects the muscles of expression (mimesis), such as those above the eyes (frontalis and orbicularis oculi superioris). Clinical symptoms are likely to include incomplete closure of the eye, drooping of the mouth, and an inability to frown, raise the eyebrow, close the eye, blow out the cheek, show the teeth or whistle.²² Disordered lacrimation and salivation (too much or too little²¹) occur not only because of loss of muscle control, but also because fibres from the facial nerve innervate both the lacrimal gland and the parotid gland and plexus (parotidectomy may in fact induce temporary facial paresis,²³ or even, unfortunately, permanent paralysis²¹). Further symptoms may include continued pain or numbness,¹⁹ loss of taste in the anterior two-thirds of the tongue due to lesion of the (sensory) geniculate ganglion of the facial nerve, and hyperacusis due to paralysis of the stapedius muscle (innervated by the stapedial branch of the nerve).²⁴ Muscle twitching may also occur,¹⁹ and one unfortunate sequela can be synkinesis, abnormal involuntary muscle movement accompanying voluntary movements of other facial muscles ('jaw winking', or twitching of the eyelid with voluntary movement of the lips, for example²⁵). These sometimes develop as recovery progresses.²⁶ Contractures were reported in one early electrotherapy RCT to occur in 23% of those with initial complete muscle denervation.²⁷ (Early fibrillation is not, unfortunately, a sign that muscle is recovering.²⁸)

Chinese acupuncture studies usually describe three (or sometimes four) stages of PFP:

1. Acute phase (up to 7 days), during which symptoms usually worsen.
2. Stable (or 'resting') period (8-14 days).
3. 'Convalescence' (from 15 days), during which there is usually a gradual improvement in symptoms.²²
4. Chronic phase (from 2 months onwards).²⁹

Without treatment, some 85% of PSP patients show initial signs of recovery within 3 weeks, a further 15% within 3-5 months. Around 66% are fully recovered by 3 months.³⁰ Thus in one study of 54 patients, voluntary movement appeared 16 days post onset on average, with full recovery by 6.3 weeks.³¹

Overall, a fortunate 80%-84%³² recover to an acceptable level within weeks to months, although 20-30%,¹⁴ or even one-third³⁰ of patients may be left with some residual symptoms. More optimistic figures have been given by one Chinese author¹⁹ (75% complete recovery, mostly

within 2-3 weeks, 15% with persistent facial asymmetry, and only 5-10% showing poor recovery at 4 months).

For those who suffer Ramsay Hunt's syndrome, there is a less than 20% chance of spontaneous recovery.¹¹

Prognosis is better for those with milder symptoms at onset, and who start to recover more quickly, indicating the presence of a neurapraxia and only partial denervation of muscle.³³ A less favourable outcome is likely in those with complete facial weakness (suggesting axonotmesis or even neurotmesis and total muscle denervation), pain other than in or around the ear, and systemic hypertension,³⁴ as well as in those aged over 50¹⁵ or 60³⁵ at onset.

Conventional treatment and electrotherapy

Conventional treatment of PFP tends to be based on antiviral medication (Acyclovir, Valtrex³⁶) and a steroid such as Prednisolone in the acute phase,^{8,37, 38,39,40} with surgical decompression reserved for serious cases (compound muscle action potential amplitude decrease greater than 90% within 2-3 weeks after onset).⁴¹ It may also include EMG biofeedback,¹⁴ and neuromuscular retraining to inhibit the development of synkinesis.²⁶

Electrotherapy originally developed in the West following the discovery in the ancient world that discharges from electric fish, particularly the mediterranean torpedo and Nile catfish (*malopterus electricus*), could be used therapeutically (although not to my knowledge for PFP). It is intriguing that Li Shizhen mentions the use of a different catfish (*parasilurus asota*) as a treatment for facial paralysis in his *Bencao Gangmu*,⁴² but this particular species (like other known species of fish in Chinese waters) does not have the shocking potential of its distant cousins in the Nile.⁴³ Electrotherapy in China is a Western import.

Electrotherapy has been used for various forms of paralysis since the mid-eighteenth century, usually with the notion that eliciting muscle twitches will somehow encourage recovery. Where applied electrical stimulation results in maximum contraction is termed the muscle's motor point. However, whereas in neurapraxia (partial denervation) it is still possible to excite facial muscle via the motor nerve, in neurotmesis (complete denervation) muscle no longer has any motor point/s and muscle fibre has to be stimulated directly. Without electrical and neurochemical input, muscle soon atrophies, with increasing degeneration and fibrosis, a process beginning within 1 to 2 weeks after the initial lesion and complete (and very possibly irreversible) by about 3 years.⁴⁴ Facial muscle, however, tends to atrophy somewhat more slowly than other larger muscles,¹⁴ and perhaps for this reason electrical stimulation can have a greater effect on the small muscles involved in PFP than on larger muscles elsewhere in the body.³²

There is much controversy over the usefulness of stimulating denervated muscle. With reduced circulation, self-repair becomes more difficult in the event of

trauma, so excessive exercise (electrically induced or otherwise) is best avoided as it may increase fibrosis. It may also delay reconnection of nerve and muscle,²⁸ and activate neurochemical feedback that in fact slows nerve regrowth.⁴⁵ Thus poorly selected electrical parameters may even inhibit neural regeneration after peripheral nerve injury.^{46,47} However, stimulation can benefit the muscle by maintaining nourishment to the tissue and aiding repair, so delaying atrophy and fibrosis even if not completely preventing them.^{44,48} It also fosters a return to normal voluntary use once reinnervation occurs.⁴⁹

One form of muscle stimulation called trophic electrical stimulation (TES) uses low frequencies and amplitudes based on the 'patterned' firing characteristics of motor units themselves, rather than the 'more is better' tradition of most methods that use constant frequencies.⁵⁰ It is therefore less fatiguing,⁵¹ and appears to maintain muscle tone by altering metabolism rather than by providing a form of 'induced exercise'.^{14,52} For PFP, TES uses a range of frequencies between 5 Hz and 15 Hz.⁵³ Interestingly, frequencies in the physiological tremor range (~10 Hz) may be more effective than twitch (slower) or tetanic (faster) frequencies in stimulating circulation (and so enhancing tissue repair).^{54,55,56,57}

Sustained contraction of muscle (tetany) occurs if completely denervated muscle is stimulated at around 3–10 Hz (a much lower frequency than in normal muscle).⁵⁸ It would thus seem logical to use low-intensity LF^{59,60} stimulation with short pulse durations, rather as in TES, in preference to the strong and long higher-frequency tetanic pulses often advocated in the past.⁶¹ Long interruptions (of 30 seconds,⁶² 4 minutes,⁶³ even 15 minutes⁶⁴) between contractions have also been advocated, with short treatments repeated at least twice or even three times⁶⁵ daily to reduce muscle fatigue,⁶³ although muscle fatigue as such may have little effect either way on the rate of reinnervation.⁶⁶ Despite these various suggestions, there are no generally accepted guidelines on optimum parameters.

If reinnervation is possible, except in simple neurapraxia it is in a race against muscle degeneration. Clearly then it is important to begin stimulation as soon as possible after the lesion,^{66,67} while it may appear futile to attempt to work an apparently fibrosed muscle. In between these two extremes, it is a matter of clinical judgement whether to stimulate or not.

Once normal innervation is re-established, there is little to be gained by continuing stimulation.⁴⁹

Electrotherapy for PFP: the evidence

Experimentally, electrical stimulation has been shown to benefit axon regeneration in rabbits with traumatic facial nerve injury.⁶⁸ Despite such evidence, and despite considerable theoretical support for the application of electrical methods in the treatment of PFP, there are

Abbreviations used

~	Approximately
ALS	acupuncture-like stimulation
CT	Controlled trial (non-randomised)
CW	Continuous stimulation (at constant frequency)
DD	Dense-disperse (alternating frequencies)
EA	Electroacupuncture
EHF	Extremely high frequency
EMG	Electromyogram
HF	High frequency
LA	Laser acupuncture
LF	Low frequency
MA	Manual or traditional acupuncture
MUAP	Motor unit action potential
N	Number of patients in a study
NMES	Neuromuscular electrical stimulation
PF	Peripheral facial paralysis (Bell's palsy)
pTENS	probe or point TENS, using a small diameter handheld probe
RCT	Randomised controlled trial
TCM	Traditional Chinese medicine
TDP	<i>Te ding dian ci bo pu</i> (type of far-infrared lamp)

TEAS	Transcutaneous electrical acupoint stimulation
TES	Trophic electrical stimulation
TENS	Transcutaneous electrical nerve stimulation
TLS	TENS-like stimulation
WM	Western medicine

Terms that may be unfamiliar to some readers

Axonotmesis	= Degeneration of nerve beyond the point of injury
Compound muscle action potential amplitude	= A measure of electrical activity in a group of muscles
Contralateral	= Pertaining to the opposite side
Cortical	= Pertaining to the (cerebral) cortex
Corticobulbar	= Pertaining to the cerebral cortex and brainstem
Denervation	= Interruption of nerve supply to tissue (may be partial or total)
Hyperaesthesia	= Increased, sometimes extreme, sensitivity to stimuli
Hyperacusis	= Exceptionally acute hearing, sometimes accompanied by pain
Infranuclear	= Below or peripheral to the nucleus of a neuron

Ipsilateral	= Situated on the same side
Neurapraxia (neuropraxia)	= Conduction block in injured nerve that recovers relatively quickly
Neuropathic pain	= Pain that originates from trauma or injury to the nervous system itself
Neurotmesis	= Complete severance of a nerve
Ramsay Hunt's syndrome	= Facial paralysis associated with a herpetic rash in or around the ear or on the roof the mouth
Segment	= Section of the spinal cord, with the skin, muscle, bone and organ regions innervated by the associated spinal nerves
Supranuclear	= Above or central to the nucleus of a neuron
Supraspinal	= Pertaining to the region above the spine
Synkinesis	= Abnormal involuntary muscle movement accompanying voluntary movements of other muscles
Tolerance	= Reduced response to treatment following prolonged or repeated use

surprisingly few clinical studies that unequivocally support the use of electrotherapy for this condition.^{14,52} In their 2003 review, Rosie Quinn and Fiona Cramp found for example that 'conclusive findings relating to the efficacy of electrotherapy in Bell's palsy are still lacking' (as so often, because of methodological shortcomings in clinical studies). However, they also suggested that 'there is no evidence to suggest that electrical stimulation is beneficial to patients with acute Bell's palsy, but evidence does exist to suggest beneficial effects of electrical stimulation in patients with chronic Bell's palsy'. Another 'best evidence' review again found no evidence (published in English) that electrotherapy is beneficial in acute PFP, although stating that its use might be justifiable in long term Bell's palsy.⁶⁹ When it comes to other electrotherapy modalities, Quinn and Cramp concluded that ultrasound may benefit acute Bell's palsy, but that there is no convincing evidence that shortwave diathermy and low intensity laser therapy (LILT) are useful for the condition.¹⁴

Given the paucity of good quality research, it is hardly surprising that an official US report from 1984 found that 'electrotherapy ... has no demonstrable beneficial effect in enhancing the functional or cosmetic outcomes in patients with Bell's palsy',⁷⁰ or that in 1989, a standard physical therapy textbook still concluded that 'electrotherapy may not be clinically effective' for this condition.¹³ Some authors even state categorically that electrical stimulation should not be used for facial paralysis.⁷¹ Others suggest that any electrical stimulation is contraindicated if its purpose is to stimulate flaccid muscles, as this may foster

the development of synkinesis, where the aim should be to inhibit contracture rather than to encourage it.²⁶ Thus Medicare in the USA does not cover electrotherapy for the treatment of PFP,⁷² while some insurance companies consider electrical stimulation only as 'investigational/not medically necessary'.⁷

It is interesting that the one study that meets with the approval of all the reviewers is one on TES.⁷³

Acupuncture

Acupuncture has frequently been used for Bell's palsy. One Chinese review of the acupuncture literature on PFP over 50 years cites over a thousand articles, of which just over 15% were randomised controlled trials (RCTs) or controlled trials (CTs).⁷⁴ Traditionally, acupuncture is considered very effective for the condition. Thus another Chinese non-systematic review of 50 studies carried out over a 10-year period found a complete recovery rate averaging some 81% (37% - 100%).⁷⁵ There are other claims of 95%⁷⁶ or even 99.6%.⁷⁷

Given the ~80% spontaneous recovery rate, it is perhaps not surprising that there are many reports of MA being helpful for facial paralysis.^{78,79,80,81,82} MA has also been employed for facial paralysis due to diabetic (motor) neuropathy, particularly of the oculomotor nerve,^{80,83} and is sometimes combined with other traditional interventions such as bleeding⁸⁴ or cupping.⁸⁵ Reviews of the many acupuncture-based methods used have been published,^{75,29,86} as well as a 2003 Cochrane systematic review on the subject. This authoritative if poorly

reported and very limited source, based on a total of only 288 patients in three RCTs in which acupuncture (or acupuncture plus medication) was reported as superior to medication alone, found that there is still 'insufficient evidence from randomised trials to decide whether acupuncture is helpful' for Bell's palsy.¹⁵ It is important to note that this review was limited to cases treated within 14 days from onset and excluded chronic sequelae and cases involving diabetes, herpes zoster or other causes. Also excluded were TEAS, pTENS and LA.

In general, clinicians and less systematic reviewers have concluded, like Zhang Hong in this journal,²² that acupuncture, whether MA or EA, can shorten time to recovery and enhance curative effect.^{87,88,89,90}

Predictably, less good results are reported for Ramsay Hunt's syndrome,⁹¹ while in one large Russian review facial paralysis of vascular origin had the least good prognosis of all the types treated.³⁵ (However, any intervention that improves local circulation is likely not only to help release local nerve compression but also to assist nerve regeneration.⁹² MA, for instance, has been found to increase facial temperature in patients with Bell's palsy,^{93,94} with temperature also increasing in response to auricular MA in one successful case.⁹⁵)

Traditional Chinese medicine (TCM) and PFP

In TCM terms, PFP is usually considered to result from the invasion of wind-cold due to an underlying deficiency of qi or poor circulation in the channels and collaterals in the face, with resultant stagnation of qi and blood. The condition may also be complicated by pre-existing phlegm.¹⁹ Disharmony of Liver qi has also been proposed as a contributory factor.⁹⁶ Acupoints may be selected according to a further differentiation (channel blockage due to wind-cold or wind-heat, qi and blood stagnation, or qi and blood deficiency).²⁹ Once PFP has become chronic, Liver and Kidney yin deficiency may complicate the picture.²⁹ One author has suggested that PFP caused by invasion of wind-cold is most responsive to acupuncture treatment.⁹⁷ It is instructive that Julius Althaus, one of the greatest European electrotherapists of the nineteenth century, attributed most cases of Bell's palsy to the influence of damp and cold.⁹⁸

Bleeding (at jing-well points),⁹⁹ and bleeding and cupping,¹⁰⁰ have been used in the acute phase of PFP, as well as bleeding alone for chronic PFP with blood stagnation.¹⁰¹

In keeping with conventional electrotherapy findings, better results have been reported with MA when higher electrical potentials are found at acupoints on the affected side than at symmetrical points on the opposite side, particularly if these potentials increase markedly with the first treatment.¹⁰² One group of researchers has also used temperature differentials between the affected and unaffected side to determine MA point selection.¹⁰³

Electroacupuncture in the treatment of peripheral facial paralysis

Because of its effects on pain, paralysis, muscle wasting, microcirculation, inflammation and nerve damage, we would expect EA to be perfectly suited to the treatment of PFP (although Bruce Pomeranz has suggested that simple manual needling may in fact induce electrical 'current of injury' levels and densities in precisely the range required for nerve regrowth¹⁰⁴).

Indeed, in experimental studies EA has been found to benefit facial nerve regeneration following trauma,^{105,106} while a quick Medline search (February 2007) using the terms 'facial paralysis' AND 'electr*' reveals more studies on EA than on all other forms of electrotherapy for PFP, at least in recent years.

Furthermore, in the present journal (*Journal of Chinese Medicine*, 1979-2006¹⁰⁷), 8 of 16 articles, case studies or abstracts on PFP included discussion of EA. And in one 2005 comprehensive review of the Korean acupuncture literature (1983-2001),¹⁰⁸ of 124 studies retrieved, 9 were on PFP, and of these only one did not make use of electrical stimulation.

The clinical studies database at www.electroacupunctureknowledge.com currently includes 167 studies on PFP, including full details of acupoints and electrical parameters used in each study (if known). Please note that this database does not include or exclude studies on the basis of methodological merit. While it provides an essential contribution for the formulation of further treatment and research protocols, authors' claims as to outcome may not be sustainable when subjected to rigorous scientific criteria.

Analysis of the clinical studies database indicates that many authors have observed that EA gives better results than MA for PFP⁷⁵ (see too below, under *Comparisons and Combinations*). Some have gone so far as to suggest that acupoint electrostimulation (without needles) is 'a method of choice' for Bell's palsy,¹⁰⁹ although others, more cautious, have stated categorically that electrical stimulation should not be used for facial paralysis.⁷⁸

Treatment according to stage and severity of paralysis

The three standard stages of PFP described in the Chinese literature have been mentioned above. Selecting appropriate acupuncture treatment at each stage may speed up recovery¹¹⁰ and improve results.^{111,112}

1. Acute phase

Symptoms normally worsen during the 7 days or so of this phase and then level off. Thus early aggravation may be erroneously attributed to acupuncture (although it may also result from incorrect treatment).²² On the other hand, stability of symptoms in one case study when treatment was started only towards the end of the acute phase was attributed to EA!¹⁹

Except in cases of simple neurapraxia it is usually considered important to begin stimulation as soon as possible after the lesion occurs, even though the effects of acupuncture may not be evident until the acute phase is over¹¹³ (except perhaps to the electrophysiologist¹¹⁴). Thus in acupuncture generally, the emphasis is very much on early treatment.^{97,115,116,117,118,119,120,121,122} In one small study ($N = 22$) of EA initiated between 1 and 30 days after onset of PFP, for example, results were better in those treated earlier.¹²³ Similarly with LILT, with better results in those treated less than 15 days after onset reported in another small study ($N = 17$).⁹ Despite such plausible evidence, Zheng Qiwei and Li Zhenbo have cautioned that EA should not be used initially, for fear of inducing spasm.^{124,19} Authors such as Cui Shugai,¹²⁵ Qiu Meihua¹²⁶ and Wu Yixin et al¹²⁰ have followed this approach.

One approach to initiating treatment during the acute phase is to use points on the healthy side of the face, and points on the affected side only in the stable period. In one MA study this gave better results than routine acupuncture and moxibustion in all three phases.¹²⁷ In another, results with contralateral MA were better than with TDP to the affected side along with intravenous medication.¹²⁸ Surprisingly, there appear to be very few studies in which EA was applied on the nonparalysed side,¹²⁹ although there are some in which it was used bilaterally on facial points.^{130,131,132}

Superficial needling has been used in several acupuncture studies,¹³³ in at least one explicitly during the acute phase and early stable period (with better results for MA than standard Western medicine, WM).¹³⁴ In another such study, although overall results were similar for both superficial needling and conventional acupuncture (MA), sequelae were less with the former,¹³⁵ and in one RCT superficial needling was better than point-to-point needling (disease stage unclear from the study abstract).¹³⁶ Superficial needling has also been used for chronic PFP.⁸⁵

Gentle needling was found superior to strong stimulation in one MA report on early stage PFP¹³⁷ (and to improve and speed up results with standard WM in another).⁸⁷ However, this may not be a universal finding: strong stimulation (with point-to-point needling) in a study of acute stage and early stable period PFP resulted in a 100% total effective rate (herbal medication and a steroid only providing 55%).¹³⁸

Although in one large RCT on acute PFP ($N = 477$), superficial MA was found superior to 1 Hz EA,¹³⁹ EA with carefully controlled parameters^{140,141,142,123} (as well as other forms of acupoint electrostimulation¹⁴³) has been found helpful during the acute phase. Thus, in another controlled trial ($N = 80$) where gentle (just perceptible) EA was started within 14 days of onset, results were considerably better than when treatment was begun later.²² Such studies appear to contradict the cautions of Zheng Qiwei and Li Zhenbo against using EA at all during

the initial acute phase (of course relatively gentle EA is by no means contraindicated later on¹⁴⁴).

Nonetheless it should not be forgotten that strong local electrical stimulation of the affected side may well be counterproductive.^{145,19} Such stimulation of denervated muscle may potentially lead to contractures and synkinesis,¹⁴⁶ especially early on.¹²⁴ However, one much cited electrotherapy RCT from 1958 found that interrupted galvanic stimulation (pTENS) sufficient to elicit only 'minimal' contractions did not adversely affect the development of facial muscle contracture despite being used in the acute phase of PSP.²⁷ Provided treatment is carefully designed and carried out, electrical stimulation is not contraindicated during the acute phase of PFP.

There is also some justification for using both ultrasound¹⁴ and (possibly) microwave diathermy¹⁴⁷ or TDP¹⁴⁸ during the acute phase.

2. Stable period

Most MA and EA studies consider the acute phase and stable period together, dividing treatment into that started in the first two weeks after onset and treatment begun later.

3. Convalescence (and chronic phase)

Prolonged sequelae of PFP (more likely in older patients) tend to be refractory to both MA and EA. Thus, as already stated, most sources emphasise the importance of starting treatment early. In a comparison of two EA case histories by Li Zhenbo, for example, PFP first treated at two months responded more slowly and less well than acute Bell's palsy treated only five days after onset.¹⁹ In contrast, one standard NMES (neuromuscular electrical stimulation) protocol, perhaps erring on the side of caution, advocates delaying treatment until two months after onset.¹⁴⁹

In line with standard acupuncture practice, treatment may usefully be continued for some weeks after apparent clinical recovery, depending on EMG findings,¹⁵⁰ although not all agree that this is essential once normal innervation is re-established.

In contrast to acute phase PSP, strong stimulation may now be appropriate.¹²¹ This was found superior to uniform reinforcing-reducing in one comparative trial of MA, for example.^{151,152} Similarly, in a number of EA studies in the clinical studies database treatment is started gently, gradually increasing intensity (and sometimes frequency) as the condition becomes more chronic.

Severity of the condition

The severity of a nerve injury will determine how rapidly recovery will take place, and what effect EA will have on this. Treatment will give poorer results in those with more severe pathology.¹⁵³

The presence of incomplete paralysis in the first week is a favourable prognostic sign.¹⁵⁴ The response of affected

muscles to an initial session of intermittent EA has itself been used to assess prognosis¹⁵⁵ (more accurate prognosis may be obtained through electrical measurement^{31,156,157,158,159,102} or other methods¹⁶⁰). In simple neurapraxia, EA may not even be needed.

If recovery is delayed, then more than a simple neurapraxia may be involved, with axonotmesis or degeneration of the nerve peripheral to the lesion (as often occurs following neuroma surgery). In these cases, recovery is likely to be incomplete. As degeneration can set in within a few days, many physical therapists consider early treatment to be important, directed at first to relieving pressure on the nerve in the case of neurapraxia.¹⁶¹ However, even treatment several years after the initial insult can produce useful results in cases of axonotmesis if patients (and practitioners) are willing to persist with it.¹⁴⁶ At this stage, the aim of treatment is to assist nerve repair and facilitate muscle reeducation.

Lesion location

Several studies indicate that the lower (more peripheral) the lesion along the facial nerve, the better the therapeutic effect of acupuncture^{162,163,24} and moxibustion.¹⁶⁴ The authors of one RCT found that whereas cases with lesions outside the facial (nerve) canal tend to recover spontaneously, lesions within the canal benefit from acupuncture.¹⁶⁵

Comparisons and combinations

Comparisons

EA is more effective than MA according to a number of studies,^{166,167,168,117,169} with fewer treatments required.^{117,170} However, in a large RCT ($N = 477$) on acute PFP, MA (with multiple superficial needling) was superior to 1 Hz EA.¹³⁹ On the other hand, LF EA gave better results than vitamin B12 acupoint injection plus medication in another report¹⁷¹ (in another RCT, point injection was found better than routine MA¹⁷²).

ptENS ('galvano-acupuncture') was found to be more effective than 'ordinary acupuncture' in one RCT.¹⁷³

TEAS was more effective than MA in one study, with fewer treatments required.¹⁷⁴ In another, the effects of EA and TEAS were similar,¹⁷⁵ whereas in a third the combination of TEAS and TDP with MA improved the results compared with those from MA alone.¹⁷⁶

LA and MA were equally effective in some studies,^{177,178} although LA was less useful than MA (or MA plus moxibustion) in one large RCT.¹⁷⁹ However, the addition of Helium-Neon LA to LF EA improved rate of cure (but not overall effective rate) in one 2003 CT.¹⁸⁰

TDP (plus medication) gave similar results to MA in one CT, but took longer to achieve them.¹²⁸

Combinations

Somewhat surprisingly, EA appears from the clinical studies database to be combined most commonly with acupoint injection for PFP.

EA has frequently been combined with TDP (possibly even more than with moxibustion), and in recent years with microwave diathermy (giving better results than diathermy alone in one report on acute stage PFP¹⁴²). Given the TCM aetiology of the condition, it is quite surprising that there are not more studies combining MA and moxibustion.

Moxibustion in combination with EA has been used in the treatment of facial paralysis,¹⁸¹ with heat considered particularly appropriate in chronic cases by some authors.^{182,183} A common sunlamp has also been used,⁸⁶ as has far infrared.^{184,185} Both moxibustion (in one study at Yangbai GB-14, Xiaguan ST-7 and Qianzheng N-HN-20,¹⁸³ in another at Yifeng SJ-17¹⁸⁶) and far infrared (TDP)¹⁴⁸ appear to improve the results of EA, as well as MA.^{176,184} The combination of far infrared with MA has also been claimed to reduce the amount of treatment needed.¹⁸⁵ In keeping with reports that EA often gives better results than MA, the combination of EA with moxibustion was found superior to MA in one RCT.¹⁶⁸

Further analysis of comparisons and combinations may be found in my textbook.¹

The role of exercise

LF EA has been combined with functional exercises.¹⁷⁰ In studies comparing acupuncture plus facial exercises with acupuncture alone, results were significantly better in the former group.^{187,188} Adjunctive exercises (whether volitional or induced) have an important role to play in PFP,⁵² particularly once recovery begins,¹¹⁵ although exercises have also been effectively combined with LF EA in acute phase PFP.¹⁸⁹ However, too much emphasis on mirror work (making faces) can be disheartening if progress is slow.¹⁹⁰ Exercise has to be tailored to recovery stage.²⁶

Points used

A TCM approach

Traditionally, points are selected according to pattern of differentiation. Ren Xiaoqun, for example, suggests the following points:

- For channel blockage due to wind-cold: Fengchi GB-20, Hegu L.I.-4 (with moxibustion).
- For channel blockage due to wind-heat: Yifeng SJ-17, Yanglingquan GB-34.
- For qi and blood stagnation: Waiguan SJ-5, Sanyangluo SJ-8, Taichong LIV-3
- For qi and blood deficiency: Zusanli ST-36, Sanyinjiao SP-6.²⁹

Anatomical acupuncture

Others have preferred a Westernised approach (see Table 3 on the website version of this article), one group suggesting that selecting points according to the distribution of the main branches of the facial nerve can be effective even with gentle or superficial MA,¹³³ another author using

such points for stronger MA with point-to-point needling in cases of more chronic PFP (ST-6 to ST-4; an empirical point midway between Yangbai GB-14 and Sizhukong SJ-23 to Xiaguan ST-7; Yifeng SJ-17).¹⁵² A rational selection of points might include Zanzhu BL-2, Sizhukong SJ-23, Yangbai GB-14 and Taiyang M-HN-9 for involvement of the first (temporal) branch of the facial nerve, Quanliao SI-18 and Chengqi ST-1 for second (zygomatic) branch involvement and Dicang ST-4 with Jiache ST-6 for the third (mandibular) branch.¹⁸² (See too Table 3). An important point is Yifeng SJ-17, located where the facial nerve emerges from within the skull.¹⁹¹

Incidentally, there are very few PFP studies comparing the effects of stimulation at acupoints and non-acupoints. In one, EA at points over the nerve trunk had a better effect than similar EA at standard acupoints,¹⁹² while in another EA at Hegu L.I.-4 and the auricular Mouth point gave superior results to MA at nonspecific points¹⁹³ (hardly a fair comparison). Non-acupoints over the trajectory of the facial nerve were stimulated in one very small uncontrolled LILT study ($N = 4$).¹⁹⁴

An alternative approach is based more on the muscles involved rather than the nerves (see Table 3). Thus Zanzhu BL-2 and Yangbai GB-14 have been recommended for difficulty in frowning, Sizhukong SJ-23 and Yangbai GB-14 for difficulty in raising the eyebrow, Juliao ST-3 and Dicang ST-4 for an inability to smile, and Yifeng SJ-17, Dicang ST-4 and Jiache ST-6 as general points.¹⁹⁵ Point-to-point needling from Zanzhu BL-2 to Yuyao M-HN-6, with Yangbai GB-14, is another method taught for incomplete eye closure in China.¹⁹⁶ Other points for EA have been suggested by Zheng Qiwei: Taiyang M-HN-9 and Zanzhu BL-2 or Sibai ST-2 for incomplete eye closure; Yingxiang L.I.-20 and Quanliao SI-18 or Xiaguan ST-7 for difficulty sniffing; either Dicang ST-4 and Jiache ST-6 or Xiaguan ST-7 and Dicang ST-4 for difficulty in puffing out the cheeks; and Kouheliao L.I.-19 and Dicang ST-4 for deviation of the philtrum.¹²⁴ Wong has given a useful account of some non-traditional muscle levator points.¹⁹¹

Staging treatment

Ren Xiaoqun suggests that during the acute (and resting) stage, only distal and proximal but not facial points should be utilised (Yifeng SJ-17, Wangu GB-12, Fengchi GB-20, Taichong LIV-3, Hegu L.I.-4, for example). If facial points are used at all, only a few should be stimulated (Xiaguan ST-7 to Taiyang M-HN-9, Jiache ST-6 to Dicang ST-4, for instance).²⁹ Zheng Qiwei also recommends that not many points should be stimulated initially, maybe two to four from the affected area.¹²⁴ Chen Kezhen, another experienced reviewer, suggests Dicang ST-4 and Xiaguan ST-7, with Yingxiang L.I.-20 and Taiyang M-HN-9 on the affected side, together with Hegu L.I.-4 on the opposite side.⁸⁶

Rather than connecting points on the face, Li Zhenbo in one case report paired Hegu L.I.-4 with Dicang

ST-4 and Hegu L.I.-4 with Jiache ST-6, alternately.¹⁹ Simple combinations of Yangbai GB-14–Hegu L.I.-4, Sibai ST-2–Xiaguan ST-7 or Dicang ST-4–Hegu L.I.-4 have been recommended for use with single-output stimulators.¹⁹⁷

The use of distal points

Although Wong is rather disparaging about the use of distal points,¹⁹¹ the authors of one MA study consider that stimulating distally does add to the effect of purely local treatment.¹⁹⁸ When using EA, one advantage of stimulating points away from the affected area is of course that there is no risk of inducing contracture or synkinesis in the early stages of PFP. Thus Zheng Qiwei quite happily recommends the early use of EA at Hegu L.I.-4 and Waiguan SJ-5 (with bilateral Hegu L.I.-4 points connected to one output of the EA device and the Waiguan SJ-5 points to a separate output).¹²⁴ In the clinical studies database there are many reports in which distal points on the limbs are used bilaterally in this way, and probably almost as many in which Hegu L.I.-4 is used, but only on the healthy side (although in one MA study, bilateral stimulation of hand points was found to be more effective than unilateral treatment⁹⁷).

Mining the clinical studies database

Looking through the numerous studies in the database, it is clear that predominantly local points are used, selected to activate particular paralysed muscles, together with some distal points. The most commonly used points appear to be Yangbai GB-14, Dicang ST-4, Jiache ST-6 and Xiaguan ST-7, with Hegu L.I.-4 (indicated > 70 times in the database), followed by Yifeng SJ-17, Yingxiang L.I.-20, Sibai ST-2 and Taiyang M-HN-9 (> 50 times), Zanzhu BL-2 and Fengchi GB-20 (> 40 times), Sizhukong SJ-23, Quanliao SI-18, Chengqiang REN-24, Renzhong DU-26 and Yuyao M-HN-6, with Zusanli ST-36 (> 20 times). Mentions of the stellate ganglion¹⁹⁹ and the crossing point of the Large Intestine and Gall Bladder channels above the clavicle²⁰⁰ are intriguing.

It should not be forgotten that stimulation of totally denervated muscle (without sensation as well as movement) is unlikely to give good results.

Parameters used

Intensity and pulse duration

Chen Kezheng has suggested that low-intensity EA should be used, just strong enough to elicit muscle contraction.⁸⁶ Alexander Meng and Gertrude Kubiena also suggest gentle motor level stimulation locally (10-15 minutes of DD or intermittent), stronger stimulation being appropriate at distal points,¹⁸² with the option of gentle and brief TEAS, daily initially for 4-5 days, then twice weekly, and so on. Only 5-10 minutes of mild motor level LF EA (every other day) is recommended in one Hong Kong text.⁵ However, in the clinical studies database, while

motor level stimulation ('to induce slight contraction of facial muscle') is emphasised, 'gentle' stimulation or stimulation 'to patient's comfort' occurs far less frequently than the standard Chinese 'intensity to tolerance' (or even 'maximum tolerance').

To obtain movement in muscle that is completely paralysed, longer pulse durations will be required²⁰¹ (even as long as 1-100 msec¹⁴⁶).

Frequency and mode

From the clinical studies database, the most frequently used frequencies and modes for EA treatment are LF, intermittent or DD stimulation, although 20 Hz, 50 Hz, 80 Hz and even 125 Hz are also mentioned. The Acupad NT 10, a TENS-like device found useful in home treatment of PFP, provides an output at a fixed 22 Hz.¹

In one interesting RCT ($N = 147$), a combination of continuous (CW) followed by DD stimulation gave better results than CW alone.²⁰² In another RCT ($N = 80$), intermittent stimulation gave better and more rapid results than LF CW (TDP was used in both groups).²⁰³ This appears to be in line with standard electrotherapy practice involving interrupted HF stimulation to patient tolerance, eliciting visible muscle contractions if possible.¹⁴⁹

On the other hand, the authors of one case study suggested that for elderly or debilitated patients, weaker (HF) EA is more appropriate than strong (LF) EA.²⁰⁴

Another approach (extrapolating from MA studies) could be LF stimulation of scalp points at around 3.3 Hz.⁷⁹ Users of the Likon device were at one time taught to utilise frequencies in the 5–10 Hz range, modulated at 0.25–0.33 Hz, for PFP.¹⁹⁷

Treatment frequency

One RCT comparing daily and twice-weekly EA for PFP found no significant difference in therapeutic effect when treatment was initiated within three months of onset.²⁰⁵

Other approaches

As a form of supervised self-treatment, low-intensity trophic electrical stimulation (TES) using low variable frequencies as found in normal motor unit action potentials (MUAPs) may be beneficial: 5-8 Hz, 80 μ s, alternating two seconds on and off, for up to eight hours daily,⁴⁴ or with submotor stimulation as described in a study by Robert Targan and colleagues.¹⁴⁶ A useful patient handbook on facial paralysis by one of the originators of TES is now available.²⁰⁶

In a wonderfully simple protocol by He Qinglin, suited to an unsophisticated rural practice, Dicang ST-4 and Jiache ST-6 are stimulated using from one to four ordinary 1.5 V batteries ('economic, convenient and effective').²⁰⁷ If such non-charge-balanced stimulation really has to be used (which with needles it should not), it may be helpful

to position needles or electrodes so that the more distal one is negative.¹

Staging treatment

Many authors emphasise gentle stimulation (with more superficial needling) during the acute phase, as mentioned above. During the convalescent stage, stronger EA becomes appropriate, with point-to-point needling²⁹ to maximise stimulation of the facial muscles themselves (rather than just the nerve fibres that feed them).

After limiting treatment to mild stimulation in the first week (acute phase), it can then be made a little stronger. This strategy is frequently found in the clinical studies database. Interestingly, the authors of one report on TEAS for various stages of PFP gradually increased both frequency and amplitude to their patients' tolerance.¹⁷³

Bearing in mind MA studies by Yu²⁰⁸ and Ni²⁰⁹ on the relation between duration of needle retention and therapeutic effect, it would seem sensible to start with shorter treatments and only lengthen them after the acute (or even 'resting') phase. This approach was adopted in EA studies by Wang,²¹⁰ Liu and Li,²¹¹ Tang and Fang,^{140, 141} and Yang et al,²¹² for example. Electrostimulation for long periods should be avoided in the early stages of PFP or if spasm is already present.^{197, 29}

On the other hand, in keeping with traditional guidelines on acupuncture treatment, Li Zhenbo suggests that early on treatment should be given daily, or every other day, but only every few days if the condition is chronic.¹⁹

Discussion: some thoughts on treatment

In this article, electroacupuncture and electrotherapy are introduced, and their application in the treatment of PFP is outlined. There is a lack of good quality data on treating PFP with electrotherapy, but a surprising amount of information is available on its treatment with EA. Each can learn from the other.

What is clear from reviewing the literature is that many different approaches have been adopted. There is no one right way to treat PFP, although there do seem to be some wrong ways. The following guidelines are suggested:

- Treatment must be adapted to the three (four) stages of PFP, with only gentle stimulation applied in the acute phase and at only a few acupoints.
- In terms of needle technique, this means superficial rather than point-to-point needling.
- For EA, it means using a low frequency at a low intensity (and possibly with a relatively brief pulse duration): sensory (even submotor) level first, motor level later.
- Initially, 15-20 minutes of EA may suffice, later 20-30 minutes.
- If in doubt, use EA during the first week only at distal points, away from the face altogether.
- In general, however, the same points are used with EA as with MA, although it is helpful to select points

according to their anatomical (muscle/nerve) location as well as their TCM function.

- The combination of local and distal points is likely to give better results than using just one or the other.
- Despite the frequent use of TLS for acute pain disorders, LF EA should be used initially (although not at high intensity, as in ALS), and possibly even through to stage 3 PFP (with increasing intensity).
- In general, DD is more likely to be effective than CW, but chronic (stage 4) PFP may perhaps respond to HF or intermittent stimulation.
- However, given that the one study that meets with the approval of all the electrotherapy reviewers is one on TES, it would seem sensible to adapt the parameters developed for this method for use with EA, perhaps using variable frequencies in the 5-8 Hz range or at around 10 Hz, rather than the more common 2-4 Hz. Treatment should be designed to foster local circulation and nerve healing, rather than simply provide induced exercise for paralysed muscles.
- Concomitant use of heat and other ancillary treatments may potentiate the effect of EA. Facial exercises are also very important.
- Treatment twice a week may be as effective as daily treatment when using standard EA (but not with protocols based on TES).

This article on the JCM website

The References to this article can be found on the JCM website at [www.jcm.co.uk/JCMJournal/Latest Issue](http://www.jcm.co.uk/JCMJournal/LatestIssue), together with the following Tables:

Table 3. The main muscles affected by peripheral facial paralysis, their innervation and possible motor point/acupoint correspondences

Table 4. Studies on EA and related modalities for PFP

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David F Mayor is the editor of *Electroacupuncture: A practical manual and resource* (Elsevier/Churchill Livingstone 2007) and the online clinical studies database at www.electroacupunctureknowledge.com.

This searchable database contains more than 8,000 clinical studies on EA and associated modalities, and is available on the CD version of his electroacupuncture textbook as well as freely accessible on the website. Full details of acupoints and electrical parameters used in each study are given where possible.

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Table 3. The main muscles affected by peripheral facial paralysis, their innervation¹ and possible motor point/acupoint correspondences²

Facial nerve branch and associated muscles	MP or nerve stimulation pt (acupoint correspondence)	Other acupoints in these muscles
Temporal Frontalis Corrugator Orbicularis oculi superioris Procerus	<i>toumie</i> (N-HN-31)? Above GB-14 <i>touguangming</i> (M-HN-5)? Below <i>yuyao</i> (M-HN-6)	BL-3, BL-4, BL-5, GB-13, GB-14, GB-15, ST-8, DU-24 BL-2 BL-1, BL-2, SJ-23, (GB-1), <i>yuyao</i> (M-HN-6), <i>taiyang</i> (M-HN-9) <i>yintang</i> (M-HN-3)
Zygomatic Orbicularis oculi inferioris Risorius [lat] Zygomaticus major [sup] Zygomaticus minor [sup] Levator anguli oris [sup] Levator labii superioris [sup] Levator labii alaeque nasi [sup] Procerus Compressor naris [med] Orbicularis oris superioris	Anterior to <i>qianzheng</i> (N-HN-20) ST-1 SI-18? <i>sanxiao</i> (M-HN-17)? ST-2? <i>bitong</i> (M-HN-14)?	ST-2, (GB-1), <i>qiuhou</i> (M-HN-8) (ST-6) ST-3 ST-2, ST-3 LI-20, (ST-4), (ST-6), DU-26, DU-27, (DU-28)
Buccal Risorius [med] Zygomaticus major [inf] Zygomaticus minor [inf] Levator anguli oris [inf] Levator labii superioris [inf] Levator labii alaeque nasi [inf] Compressor naris [lat] Dilator naris Orbicularis oris inferioris [lat] Depressor anguli oris	Anterior to <i>qianzheng</i> (N-HN-20) ST-3? ST-4?	(ST-6) LI-20 (LI-20) (ST-6) (ST-6)
Mandibular Orbicularis oris inferioris [med] Depressor labii inferioris Mentalis	Anterior to ST-6 <i>jiachengjiang</i> (M-HN-18)?	(ST-4), REN-24 REN-24, <i>jiachengjiang</i> (M-HN-18) REN-24

(Points in brackets may require needling at an angle to enter indicated muscle)

Table 4. Studies on EA and related modalities for PFP

Modality	Totals	RCT	CT	Case series	Case report
MA	9 (32)	1 (11)	(8)	4 (6)	3 (5)
EA	106 (125)	13 (23)	13 (17)	69 (71)	9 (12)
pTENS	2 (2)	(1)		1 (1)	
TEAS	8 (8)	2 (2)	1 (1)	5 (5)	
TENS	0 (3)		0 (1)	0 (2)	
LA	16 (17)	2 (2)	8 (9)	4 (4)	2 (2)
LILT	1 (2)			1 (1)	0 (1)
Other methods	18 (31)	2 (7)	2 (7)	13 (15)	1 (2)

(Figures in brackets show numbers of studies in an update currently in progress)

MA = manual acupuncture; EA = electroacupuncture; pTENS = probe or point TENS; TEAS = transcutaneous electrical acupoint stimulation; TENS = transcutaneous electrical nerve stimulation; LA = laser acupuncture; LILT = low intensity laser (or light) therapy (d) = descriptive study; (r) = review; (u) = uncertain

'Other methods' include more traditional ones such as moxibustion, cupping, massage, bleeding, hot compresses, catgut embedding and blister therapy, as well as modern methods of heating ('far infrared' TDP lamp, microwave or 'ultrashort wave' diathermy and other imprecisely specified forms of 'electronic moxibustion'), ultrasound, various forms of magnetic treatment, extremely high frequency (EHF) stimulation using millimetre wavelengths, and even hyperbaric oxygen. Studies on measurement or providing insufficient data for any meaningful analysis have been excluded from this Table.

Although this is a biased selection of studies, it is clear that EA is commonly used for PFP, and that a wide range of other electrical modalities has also been explored.

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