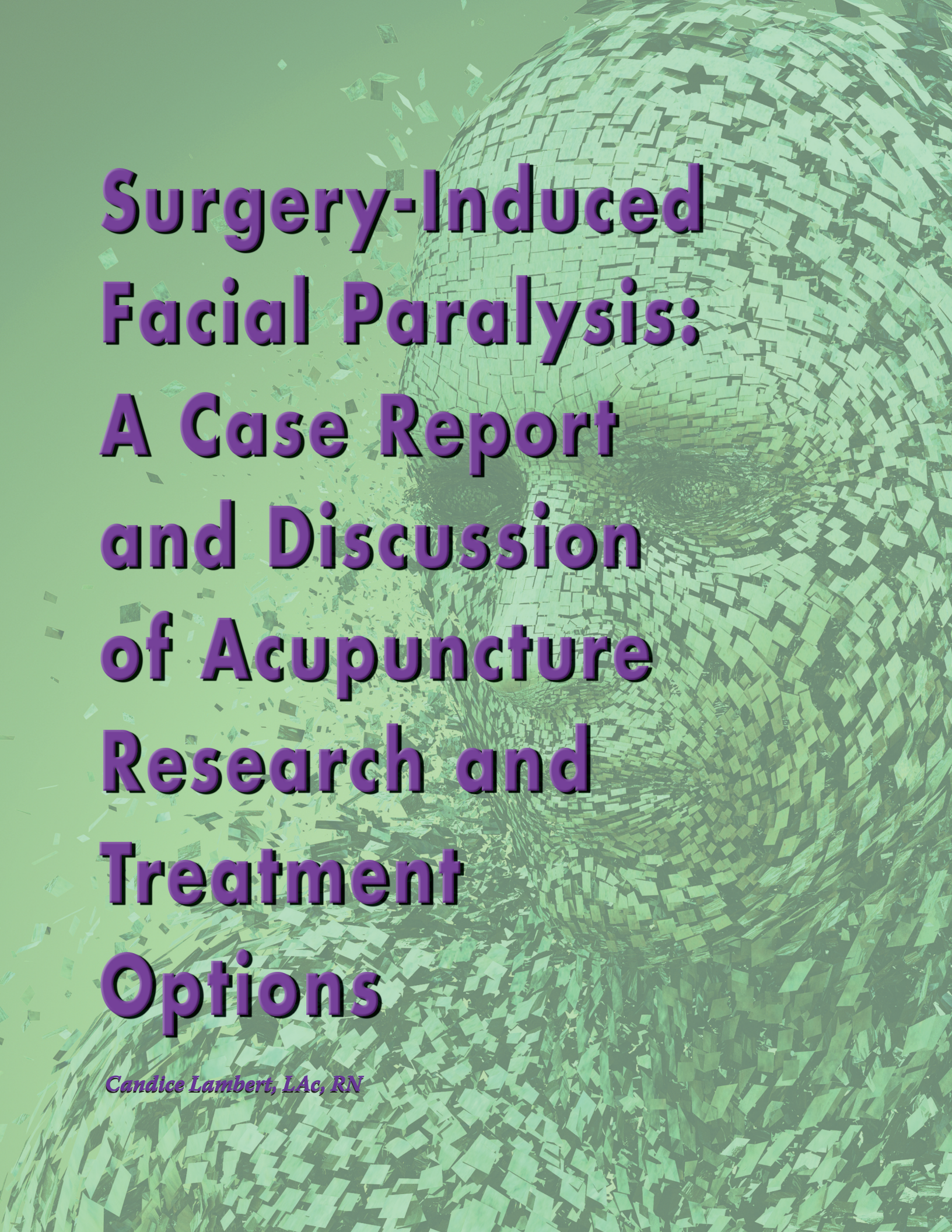

# Surgery-Induced Facial Paralysis: A Case Report and Discussion of Acupuncture Research and Treatment Options

*Candice Lambert, LAc, RN*

# Introduction

*The purpose of this article is to discuss the effect of acupuncture on improving right-sided facial paralysis incurred after surgery to remove an acoustic neuroma in the right side of a patient's brain. She also had a brainstem stroke during the surgery, leaving her with left-sided body paralysis. Subsequent medical treatment involved a right-sided muscle and nerve graft and stem cell therapy. The emphasis of this article, however, is on treating the facial paralysis.*

*The neuromuscular anatomy of the face will be discussed to explain the effect an acoustic neuroma has on facial function, and the medical reasons behind the need for surgery will be explained. The emotional and physical effects of both the neuroma and subsequent surgery can be traumatic. Surgery in this region of the head can damage the cranial nerves (CN), particularly the trigeminal nerve (CN5), the facial nerve (CN7), and the vestibulocochlear nerve (CN8). Damage to CN7 can be the most devastating as it controls the muscles of facial expression, and damage to this nerve will cause facial paralysis. This discussion centres primarily on this nerve.*

*Research, especially manual acupuncture (MA) and electroacupuncture (EA) research, will be discussed to evaluate the effects of acupuncture on restoring facial nerve function. The patient's right-sided facial muscles of expression were stimulated mainly using protocols called Constitutional Facial Acupuncture (CFA) and Facial Gym Exercises developed by Mary Elizabeth Wakefield, LAc, MS, MM, CFA uses a constitutional approach to the facial landscape which treats the body as well as the face. The muscles of facial expression can be stimulated through the use of motor points and/or acupuncture points at the origin and insertion of the facial muscles. EA can be used with the origin and insertion technique in CFA.*

*In addition to CFA and Facial Gym Exercises, the microsystem of auriculotherapy was utilised to treat the external and internal scars resulting from the patient's original surgery. The effectiveness of treatment was evaluated using the House-Brackmann Scale of Facial Movement and nerve conduction studies (NCS) performed in October 2017. The treatment protocols described in this article specifically cover the two and a half years from December 2014 to July 2017. Although the patient's therapy has continued from July 2017 to the present day, the treatment emphasis has changed and is not the subject of this current discussion. Outcomes included improvements in right-sided muscle tone and the beginning of movements around the right inner eyebrow and right side of the patient's mouth near ST 4 [Di cang]. The original surgery report stated that the right CN5 was damaged, though functioning; however, CN7 and CN8 had been destroyed. The NCS conducted in October 2017 showed a functioning, though damaged, right trigeminal nerve, and no motor function along the facial nerve. The movement near ST 4 [Di cang] can be attributed to the increasing use of the nerve graft. The cause of the movement at the inner right eyebrow is speculative and was not elaborated upon by the neurologist who conducted the NCS. This case history also demonstrates how positive integration can occur between Traditional Chinese Medicine (TCM) and Western Medicine (WM).*

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Many authors are now explaining how both medical paradigms can work harmoniously together

## Western Medicine and Traditional Chinese Medicine: An Integrative Approach

These two Medical Systems originate from different cultures and different philosophies and boast vastly different types of practice. For example, Galen, the renowned Roman physician in the 2nd Century BC, was meticulously performing experimental neurosurgery on animals and explaining the sensory and motor nerve supply to the brain (Besser, 2014) at a time when physicians in China paid scant attention to the physical structure of the interior of the body with only a brief description of the internal *zangfu* organs. There was no study of the distribution of nerves or the origins and insertions of the muscles. The Chinese did describe in minute detail, however, the pathways of Qi and blood throughout the entire body and how this linked the body as an integrated whole (Deadman, P., et al., 2001). Fast forward 2,000 years to the 21st Century, and many authors are now explaining how both medical paradigms can work harmoniously together without attempting to annihilate each other. For example, TCM channels can follow an almost identical distribution of nerve pathways in the body, such as on the yin aspect of the lower arm. The TCM ancient texts also explained in detail the different sensations of Qi when the body is touched. For example finger pressure is felt by stimulation of the A-beta skin nerve fibre, and a pinprick sensation is felt by stimulation of the A-delta skin nerve fibre (Corradino, M.D., 2017).

In this day and age an understanding of anatomy, physiology, and medical conditions as described by WM can only enhance an acupuncture treatment, especially where the treatment of damaged nerves and muscles is concerned. This was the case with this patient for whom WM diagnosed her condition; surgery saved her life; and TCM, with its exquisite understanding of the flows of energy in the body, became an integral part of her recovery.

## The Neuromuscular Anatomy of the Face

The nervous system consists of the Central Nervous System (CNS) and the Peripheral Nervous System (PNS). The CNS includes the brain in the cranial cavity and the spinal cord in the vertebral canal. The PNS includes the spinal nerves, the cranial nerves, and the autonomic nerves (White, 2008). The PNS is subdivided into the voluntary system (skeletal muscle

under conscious control) and autonomic nervous system (which innervates the glands, cardiac muscle, and smooth muscles such as those of the digestive and respiratory systems) (Farlex, 2003-17).

The receptor end organs (dendrites) of afferent neurons (sensory neurons) receive information from the skin, the internal organs, and the muscles and transmit the stimuli to the brain. Efferent neurons (motor neurons) take information from the brain and other nerve centers and form synapses with visceral muscle (smooth muscle, cardiac muscle, and glands) and with skeletal muscle fibres to produce motion. The junction between a motor neuron and a skeletal muscle fibre is called a motor end plate (Farlex, 2003-17).

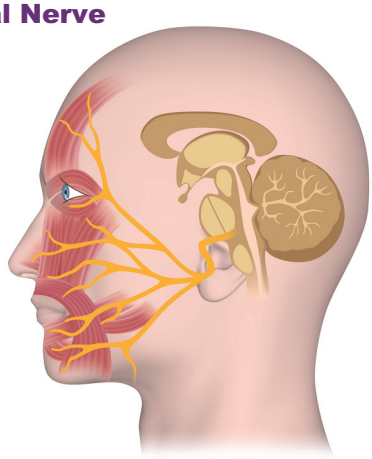
The twelve pairs of cranial nerves arise directly from the brain. The three cranial nerves of most interest to this discussion are CN5, CN7, and CN8.

- **CN5** – the trigeminal nerve – is primarily a sensory nerve which enervates three parts of the face – the ophthalmic area (scalp, forehead, nose, and upper eyelid), the maxillary area (cheeks, lower eyelid, nasal mucosa, upper lip, upper teeth, and upper palate), and the mandibular area (anterior 2/3 of the tongue, oral cavity, lower teeth, lower lip, and part of the external ear). The motor area of the nerve innervates the muscles of mastication. There is also a parasympathetic branch that innervates various glands.
- **CN7** – the facial nerve – is primarily a motor nerve. It brings sensation to part of the external ear, taste to the anterior 2/3 of the tongue, movement to the muscles of facial expression, and visceral movement to the lacrimal glands, the submandibular and sublingual glands, and the mucous glands of the mouth and nose.
- **CN8** – the vestibulocochlear nerve – is the nerve controlling hearing and balance.

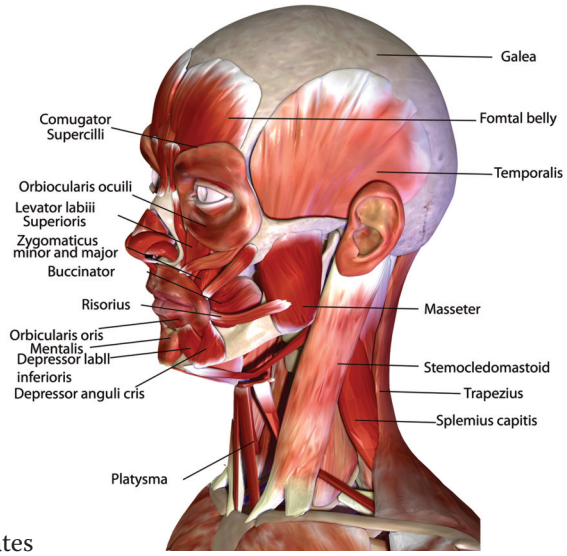
(Teach me anatomy, 2017)

The facial nerve arises in the pons of the brainstem. It passes through the internal acoustic meatus (an opening in the temporal bone) and then into the facial canal. It exits the cranium at the stylomastoid foramen and splits into five branches which innervate the muscles of facial expression (Teach me anatomy, 2017). The upper four branches, the temporal, the zygomatic, the buccal, and the mandibular, innervate the main muscles of facial expression. The temporal branch innervates the muscles in the forehead, the upper part of the eye, and the upper part of the nose; the zygomatic branch innervates the muscles of the lower eye, the lower part of the nose, the upper cheek, and the upper mouth; the buccal branch innervates the lower cheek, nose, and lower mouth; and the mandibular branch innervates the lower mouth and chin (Mayor, 2007).

**Facial Nerve**



**Muscles of the Face**




*Photos by Shutterstock*

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# Damage to cranial nerves CN5, CN7, and CN8: The emphasis on CN7

Facial paralysis is the result of a motor neuron lesion. Most cases of paralysis result from virally induced inflammation of CN7 from herpes simplex or herpes zoster infection. The nerve can also be compressed due to vasospasm or oedema, usually in the mastoid region; and it can be damaged from trauma or from surgery, such as the removal of an acoustic neuroma (Mayor, 2007).

An acoustic neuroma (vestibular schwannoma) is a benign, slow-growing tumor that arises from the schwann cells forming the sheath (covering) of the vestibulocochlear nerve. It originates in the internal auditory canal and grows in the angle formed at the junction of the pons, medulla, and cerebellum, called the cerebellopontine angle (Teach me anathomy, 2017). Its growth can compress the vestibulocochlear nerve, the facial nerve, and the trigeminal nerve (Andaluz & Tew, 2016). CN7 and CN8 extend out of the brainstem next to each other, and any damage to that area (from the tumour or surgery) will usually affect both nerves. If the tumor is not removed it will continue to grow, impinging upon nearby structures, and can eventually be fatal (Davila, 2008-17).

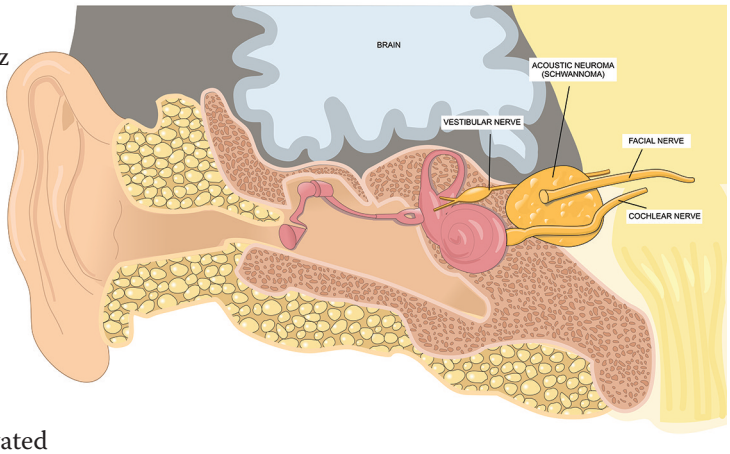


*Photo by Shutterstock*

Damage to CN5 will cause facial numbness (Andaluz & Tew, 2016). Damage to CN8 will cause deafness and severe balance issues (Davila, 2008-17). Damage to CN7, however, can have devastating effects physically and emotionally. It will cause an inability to raise the eyebrow, blink, produce tears, hold food in the mouth, and talk clearly; and it can cause a droopy eyelid, nasal congestion/runny nose, and a dry mouth. The entire side of the face will also droop (Davila, 2008-17). The muscles of swallowing are innervated by CN9 and CN10, and the muscles of mastication are innervated by the mandibular branch of CN5, so these functions are still possible with CN7 damage (Teach me anatomy, 2017). Emotional distress from damage to CN7 can be extreme (Zhaohong, 2014). Patients with facial paralysis experience intense psychological distress about their condition because of poor self-image and difficulty in reacting to others socially (Ho & Byrne, 2016). The muscles of facial expression are a primary means of human communication for the identification of feelings and ideas. Precise control of these muscles takes human communication beyond the verbal and contributes to facial expressivity (Fabrin, et al., 2015).

Facial expressions allow humans to send nonverbal messages to other people and telegraph what we are thinking and feeling. Others are alerted to the ebb and flow of emotional states even before the actual voicing of anger, frustration, sadness, or joy. Facial muscles are subject to conscious and unconscious expression, and these habitual contractions form wrinkles in that muscle. Each muscle innervated by the facial nerve conveys a different emotion. For example, the corrugator supercilii at the inner part of the eyebrows will form a frown line that conveys suffering, anger, concentration, impatience, or depression (Wakefield, 2014).

In this tiny facial nerve there are over 8,000 nerve fibres. For normal function, only about half of our facial nerve fibres are needed. If the facial nerve is only mildly damaged, the "core" (axon) of the nerve itself will regenerate slowly (approximately one inch per month) all the way back to the muscles in the face (Facial nerve and acoustic neuroma, 2012). The nerve can regrow at an average of 1mm daily (Mayor, 2007), and most natural healing will occur within the first year (Davila, 2008-17).

With severe nerve damage the insulation of the nerve (myelin) degenerates (Facial nerve and acoustic neuroma, 2012), and axonotmesis occurs (degeneration of the nerve proximal to the injury) (Mayor, 2007). The nerve itself and the motor endplate fibrose, and the muscle atrophies. In longstanding paralysis of a year or more the motor endplate muscle unit may actually fuse (Ho & Byrne, 2016). The degenerative processes start within two weeks of paralysis and may be irreversible after three years (Mayor, 2017).

Surgery to remove a tumour leaves the facial nerve fragile and easily torn. It has the consistency of a butterfly's wing. It is also tiny, as it is less than one to two millimeters in diameter (Facial nerve and acoustic neuroma, 2012).

Complete severance of the nerve means it is highly unlikely to grow back to its target tissue (Mayor, 2007). A transected (cut) nerve needs to be surgically repaired for function to be resumed. This provides an intact nerve supply from the facial motor nucleus in the pons of the brainstem to the muscle endpoint. Acoustic neuroma surgery puts the facial nerve at risk in the cerebellopontine angle. Hence repair is not feasible, as the nerve stump is not long enough for repair (Ho & Byrne, 2016).

## Tests for Evaluating Facial Nerve Function

The tests available for evaluating the status of facial nerve function include nerve excitability testing (NET), maximal stimulation testing (MST), electromyography (EMG), and electroneurography (ENoG). The two that are considered most useful are ENoG and EMG. ENoG is an objective quantitative measurement of nerve function. It measures the response on the normal side of the face upon stimulation and compares the amplitude of the response to that on the paralyzed side. The measurement

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The degenerative processes start within two weeks of paralysis and may be irreversible after three years.

is thought to correspond to the number of remaining functional nerve fibres. EMG is often complementary to ENoG. It can be used to determine if the nerve in question is in fact intact (Ho & Byrne, 2016). Nerve Conduction Studies (NCS) can provide information on the type of nerve fibre involved (motor, sensory, or both), the pathophysiology (axonal loss vs. dymelination), and the location (Schroder, et al., 2007).

The House-Brackmann Scale of Facial Movement classifies the degree of facial paralysis a person has suffered. It ranges from Grade 1 – normal function to Grade 6 – total paralysis. It is the golden standard for evaluating facial nerve paralysis with non-computerized systems. However, objective measures for evaluating facial paralysis still have a subjective bias due to the complexity of facial nerve anatomy and variation in inter-observer agreement. Even computer-based facial analysis systems need further development (Brenner & Neely, 2004).

## House-Brackmann Scale of Facial Movement

| Grade | Appearance | Movement |
|---|---|---|
| 1 | Normal<br>Normal Resting Tone | **Forehead:** Normal<br>**Eye:** Normal<br>**Mouth:** Normal |
| 2 | Slight Weakness<br>Normal Resting Tone | **Forehead:** Moderate to good movement<br>**Eye:** Closure with minimal effort<br>**Mouth:** Slight asymmetry |
| 3 | Nondisfiguring Weakness<br>Normal Resting Tone | **Forehead:** Slight to moderate movement<br>**Eye:** Closure with maximal effort<br>**Mouth:** Slight Weakness and maximal effort |
| 4 | Disfiguring Weakness<br>Normal Resting Tone | **Forehead:** None<br>**Eye:** Incomplete closure<br>**Mouth:** Asymmetric with maximal effort |
| 5 | Minimal Movement<br>Asymmetric Resting Tone | **Forehead:** None<br>**Eye:** Incomplete Closure<br>**Mouth:** Slight movement |
| 6 | Asymmetric<br>Asymmetric Resting Tone | **Forehead:** None<br>**Eye:** None<br>**Mouth:** None |

*House-Brackmann Scale of Facial Movement. Compiled from open source images on the Internet, 2018.*

# Diagnosis and Treatment from a Traditional Chinese Medicine Perspective

Facial nerve damage and the resultant lack of movement in the facial muscles and tendons can be eloquently explained by Traditional Chinese Medicine (TCM).

The nervous interruption in the conduction of impulses along the facial nerve causes a disruption to the movement of Qi and blood to the yang meridians of the face. The facial muscles then lose their ability to contract because of stagnation and malnutrition, and an imbalance of yin and yang occurs (Fabrin, et al., 2015). Yang is damaged by attacks of external wind and cold and can be further compromised by internal factors such as emotions, phlegm, and liver qi stagnation (Fabrin, et al., 2015; Mayor, 2007). Once the condition is chronic, liver and kidney yin deficiency can complicate the picture (Mayor, 2007). Stagnation of the liver causes the facial tendons and meridians to receive insufficient Qi and blood, and this can result in peripheral drooping of the facial muscles (Cai, et al., 2015).

Qi is a complex concept that does not translate neatly into the English language. This force or energy, according to Daoist philosophy, moves through the universe; and, in TCM beliefs, it moves through meridians, which infuse the physical structures of the body, constantly changing into different types of Qi (Maciocia, 1989). Muscles, tendons, and nerves are physical structures; when they are damaged, Qi and blood can stagnate. Acupuncture can help move the stagnation, as discussed in the research below. When these physical structures are severed (as with nerves), then the Qi and blood get stuck in the gap nearest to the center of the body and cannot get across. Surgery to repair that physical structure then becomes the only option. In this way, TCM and WM combine to provide the very best outcome for the patient.

The points used with acupuncture treatments for facial paralysis can be approached in several ways. TCM can use patterns of differentiation such as channel blockage from wind cold or Qi and blood stagnation. A more Westernised approach can be used which follows the main distributions of the facial nerve or chooses specific facial muscles to needle (Mayor, 2007).

In a comprehensive review of the literature on electroacupuncture (EA) Mayor has found that EA is superior to MA for treating peripheral facial paralysis. Parameters for treatment include the phase of the disease. The acute phase covers the first seven days of onset of the paralysis; the stable phase encompasses the next 8-14 days; the convalescent phase lasts from 15 days to two months; and the condition becomes chronic after two months. Gentle stimulation with superficial needling, no EA, and only a few acupoints should occur during the acute phase. During the convalescent stage EA should commence with low frequency and low intensity, initially with brief pulse duration at a sensory level and then at a motor level later (to elicit muscle contraction). EA should start with 15-20 minutes and then extend to 20-30 minutes. In later stages a dense disperse (DD) pattern is more effective than continuous (CW), but chronic paralysis may react better to high frequency (HF 50-200 HZ) or intermittent stimulation. Strong EA stimulation may now be appropriate with point-to-point needling (Mayor, 2007).

Some authors caution that EA should not be used during the acute stage of paralysis (i.e., the first seven days according to Mayor, 2007) as the facial nerve is ischemic and oedematous. An overload of stimuli is believed to cause changes in the myelin layer (Fabrin, et al., 2015). This can lead to reinnervation in undesirable areas, resulting in spasms, abnormal movement, and synkinesis (miswiring of the nerves) (Facial Nerve and Acoustic Neuroma, 2012; Fabrin, et al., 2015).

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Different modalities have beneficial effects on nerve repair in different ways

# Acupuncture Research

### Facial Nerve Damage from Disease

Research, both case histories and larger empirical studies, indicates that acupuncture can have a beneficial effect on facial paralysis. Therapy encompasses EA, MA, facial exercises, moxibustion, infrared heat, and laser. Additional therapies include medications, physiotherapy, dietary advice, and counselling. As the patient who is the subject of the present article was primarily treated with MA and EA, this section will concentrate on research involving MA and EA. Mayor states that the addition of other therapies to EA and MA enhances their effects (Mayor, 2007).

Different modalities have beneficial effects on nerve repair in different ways. Acupuncture can restore nerve function by improving local blood circulation, eliminating oedema, and reducing facial nerve inflammation (Wang, 2014; Mayor, 2007). Infrared heat therapy using the red spectrum of visible light has many beneficial photochemical effects such as activating catalase in cell mitochondria. Overall the effect reduces nerve tissue inflammation and alleviates paralysis (Wang, 2014). Electroacupunture improves excitability, flexibility, and reactivity of the nervous system (Zhaohong, 2014). Low power laser therapy provides immediate protective effects that enhance the functional activity of the damaged nerve as many acupuncture points overlie the course of peripheral nerves. Laser acupuncture is expected to work by decreasing inflammation and increasing circulation and cellular activity (De Olivera, et al., 2016).

Virally-induced facial paralysis can be treated effectively with MA in the acute stage, and with both MA and EA during the stable stage of the disease, as demonstrated by the following few research reports. The overall results demonstrate that EA is superior to MA alone and that when MA and EA are combined with other treatments improvements in patient outcomes are enhanced.

Acupuncture, acupoint massage, psychological counselling, and health education were given over a four-week-long period to treat Liver Qi stagnation paralysis in 57 patients. Treatment began within seven days of the onset of symptoms; however, in the acute seven-day phase, manual acupuncture was gentle, and the total treatment effectiveness rate was 87.72% (Cai, et al., 2015).

In another research project 49 people with Bell's Palsy with onset from three weeks onwards were treated with EA for 25 minutes a day for ten days.

Two courses of treatment were given. All cases showed recovery, and it was concluded that EA was effective in treating facial palsy (Bokari, et al., 2010).

Moxibustion and acupuncture enhance treatment results. In this study 624 patients with facial paralysis were randomly divided into a treatment group and a control group within the acute stage of the disease; treatment continued for four weeks. The treatment group received acupuncture and moxibustion and had a total treatment effectiveness rate of 74.9%. This result was superior to the control group treated with pharmaceutical products alone. They experienced a total treatment effectiveness rate of 51.8% (Li, et al., 2005).

Infrared heat therapy also proves beneficial when combined with acupuncture. Ninety-six patients were divided into two treatment groups and treated within six days of the onset of symptoms. Treatment continued for two weeks. The treatment group received acupuncture and infrared heat therapy and achieved a 91.67% total treatment effectiveness rate. The control group received standard medical treatment and reported a 60.42% treatment success rate. Acupuncture and infrared increased the effectiveness of treatment by 31.25% (Wang, et al., 2014).

Rehabilitation, facial muscle training, and EA combined with manual acupuncture and physiotherapy give superior results to MA and physiotherapy alone in the early stages of facial paralysis. In a four-week trial, 102 patients with inflammation of the facial nerve were divided into control and treatment groups. Treatment began within three days of the onset of facial paralysis. EA commenced in the treatment group eight days after the onset of facial paralysis. Those receiving EA and rehabilitation training, including facial muscle training, statistically outperformed those receiving manual acupuncture and physiotherapy only (Zhaohong, 2014).*

Manual acupuncture and EA can be used effectively in the chronic stage of virally-induced facial paralysis. A case study was reported of a 44-year-old woman who had peripheral facial palsy on the right and synkinesis in the left eye for twenty years. Electrical stimulation was applied around ST 4 (*Di cang*), and manual stimulation of other points. There were 20 sessions of 20 minutes each. In conclusion there was greater activation and recruitment of muscle fibres on the right side and a reduced overload on the left side, which promoted a functional evolution of movements. Acupuncture associated with electrical stimulation reversed the peripheral facial paralysis in a short time (Fabrin, et al., 2015).

## Facial Nerve Damage from Trauma

As the facial nerve is part of the PNS it is useful to discuss improvements in nerve function of other peripheral nerves attributed to acupuncture when the lesion is caused by trauma (accident or surgery) or paralysis of unknown origin. The greater the damage to the PNS, the less the chance of full recovery.

The therapeutic effect of acupuncture on peripheral neuropathy was measured by nerve conduction changes and subjective symptoms. In this study the subjects had peripheral neuropathy of undefined etiology. The treatment group of 21 patients with neuropathy of the lower extremities received acupuncture, and 26 patients received conventional medical treatment. It was concluded that acupuncture had a positive effect on peripheral neuropathy. Acupuncture may enhance blood flow and hence nerve repair in axons and myelin sheaths (Schroder, et al., 2007). Upper and lower limbs

* *In WM hand, feet, and face therapy is a specialty which is usually, but not always provided by occupational therapists rather than physiotherapists. Rehabilitation involves a multitude of specialists including physicians, nurses, physiotherapists, and social workers.*

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were treated in patients who had nerve damage of sensory, motor, and autonomic nerves. Fifty patients were divided into treatment and control groups. Both groups had EA treatment for 30 minutes once a day, five times per week, for six weeks. Both the control and treatment groups had EA along the area of peripheral nerve damage. In addition the treatment group had treatment along the Du meridian (for the spinal cord). This is because peripheral nerve damage causes cell death in corresponding segments of the spinal cord. Clinical effect was statistically significant with 80% of the treatment group showing improvements through nerve conduction tests compared to 38% of the control group (He, 2015).

In one case history a 30-year-old woman had right-sided facial paralysis treated with TCM two months after the removal of a 4-cm acoustic neuroma. Her facial nerve had been severely damaged but not severed completely. On resting her face appeared normal; however, she had a House-Brackmann score of 4 and deafness in her right ear. Acupuncture treatment began three times a week, then over a period of time became monthly. Flash cupping and EA were used. She also used a TENS machine at home along with blood-nourishing foods and facial exercises. Over the course of a year movement around her eye and mouth had improved slowly (George, 2017).

Complete severance of a nerve requires surgical intervention before nerve impulses (or blood and Qi in the TCM world) can move along that nerve again. However, it seems both MA and EA can help with nerve regeneration after surgery.

The British Acupuncture Council has commented that there is evidence acupuncture may aid nerve regeneration, but these experiments come from animals (BAC, 2016). One study corroborates this. A gap was made in the median nerves of rats. After transection the nerve was rejoined with sutures and silicone rubber tubes. The transected nerves were treated by acupuncture and electroacupuncture. Compared to the control group the group receiving acupuncture and electroacupuncture treatments had a larger total nerve area and number of blood vessels, larger amplitude and larger area of evoked muscle action potentials, and enhanced ability of the injured paw to regain its grasping power. It was concluded that acupuncture and EA have a positive effect on the nerve regeneration process (Ho, C.Y., et al., 2013).

# The Patient

## Background

The patient in the present case report had a 5-cm right-sided acoustic neuroma removed in 2003. According to the surgical records, the facial nerve, CN7, was severed near the entry to the internal acoustic meatus due to complications during the surgery caused by brain stem swelling. The vestibulocochlear nerve, CN8, was severed due to the tumor removal; however, CN5, the trigeminal nerve, was damaged but still intact. The patient also had a brain stem stroke during the surgery. These events left the patient with right-sided facial paralysis with every one of the previously mentioned sequelae of facial nerve damage. In addition, because of the CN8 severing, she also has right-sided deafness. Because of the damage to CN5, her face sensations are altered; and because of the stroke, she has balance issues, slurred speech, and left-sided body paralysis. She walks with a stick, frequently falls, and needs someone with her to mobilise for safety. She has full cognitive function except for minor memory loss. The effects on her physically, emotionally, and socially were devastating. She was 22 years old.

She was in hospital for eight months and underwent intensive rehabilitation. A gold weight was inserted into her right upper eyelid. The orbicularis occuli muscle controls eye closure and is innervated by the temporal and zygomatic

branches of the facial nerve (Teach me anatomy, 2017). Loss of function of this muscle will put the eye at risk of drying out. The gold weight enables the eyelid to close and keep the eye moist.

In 2004 the patient underwent a nerve, muscle, and blood vessel graft to give her the ability to smile on the right side of her face. According to the operation notes, the donor nerve supply was provided by the left facial nerve and a harvested left sural nerve from her calf; the donor muscle was provided by a strip of left gracilis muscle from her inner thigh; and the donor blood vessels were a vein and artery harvested from the femoral area. The buccal branch of the left facial nerve was divided and the division was attached to the sural nerve. The sural nerve was then taken under her nose to the right side of her face and attached to the gracillis muscle near ST 4 (*Di cang*). The gracilis muscle was inserted into the temporal fascia and the orbicularis oris at the right side of her mouth. Surgery was completed with the harvested blood vessels being attached to the facial blood vessels. In 2006 more facial surgery was performed to reanimate the first gracilis muscle and provide further motor nerve stimulation by using the right-sided mandibular nerve to innervate the top of the gracilis. The mandibular nerve is a branch of the trigeminal nerve, CN5, that provides motor innervation to the masseter muscle (Teach me anatomy, 2017).*

Essentially the patient uses the left facial nerve to smile on the right side of her face using the gracilis muscle graft. The patient can smile using this muscle, but this is only on rare occasions as it is usually a conscious movement initiated by having to clench her teeth. During the course of the treatments it became more spontaneous and subconscious. (Further discussion of future treatment options using this graft is given in a later section entitled "Discussion and Future Directions for Treatment.")

In 2014 she underwent intravenous and spinal stem cell therapy in Thailand over a four-week period. Improvements were slow. This therapy also included acupuncture five times a week for her face and eye.

The patient came for acupuncture at the end of 2014 as she had enjoyed it during her time in Thailand and was hoping for some improvements.

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Essentially the patient uses the left facial nerve to smile on the right side of her face using the gracilis muscle graft.

* *Permission was given by the patient to the practitioner to view all operation reports. The practitioner has the clinical ability to interpret the reports because she is a registered nurse and acupuncturist.*

She was in the chronic phase of the disease – eleven years of paralysis. Flaccid paralysis of the right side of the face with stagnation of Qi and blood in nerve, muscle, and tendon was diagnosed. This was complicated by internal phlegm and cold and liver Qi stagnation. The facial muscles, tendons, and nerve were starved of Qi and blood because of structural damage. The sequelae of the stroke were being treated with other modalities, such as kinesiology, ENAR, physiotherapy, and chiropractic treatments.

## Acupuncture Techniques Used

During the two and a half year course of treatments the following techniques were used to treat the patient: Constitutional Facial Acupuncture, Electroacupuncture, Facial Gym Exercises, Auriculotherapy, Hypnosis, and various other modalities.

### Constitutional Facial Acupuncture (CFA)

This protocol was developed by Mary Elizabeth Wakefield in the USA. CFA uses a constitutional approach to the facial landscape that treats the body as well as the face. The body points protocols in the CFA provide a wide range of choices including the kidney spirit points for spiritual and emotional issues (these lie over the heart on the kidney meridian and encompass KD 22 [*Bu lang*] through KD 26 [*Yu zhong*]), the eight extraordinary meridian master and couple points, the Windows of the Sky, and combinations of points from the 12 regular meridians and the 12 tendinomuscular meridians, depending on the focus of the treatment (Wakefield, 2014). The CFA techniques also use non-needle modalities including tuning forks, essential oils, topical Chinese herbs, facial exercises, and gems (Wakefield & MichelAngelo, Non Needle Modalities, 2015; Wakefield & MichelAngelo, Vibrational Facial Acupuncture Renewal, 2016).

CFA tones the muscles of facial expression innervated by the facial nerve. The practitioner can strengthen a weakened muscle or relax an overly contracted muscle through two techniques – the origin/insertion muscle method or motor point stimulation. In the origin/insertion method needles are inserted into the origin of the muscle (the end attached to the bone) and into the insertion of the muscle (the end attached to the skin or muscle fibres). The origin of the muscle should always be needled first (Wakefield, 2014). In the motor point stimulation method an acupuncture needle is inserted into the motor point of the chosen facial muscle. A motor point exists at a neuromuscular junction. It is a specific location where nerves enter a muscle. When an acupuncture needle is used at these motor points, the muscle "fires" and resets its spindle, which is accompanied by a grabbing/gripping action (Wakefield, 2014; Wakefield & MichelAngelo, Advanced Constitutional Facial Acupuncture Renewal, 2015).

**Needles for CFA Motor Points:** Seirin J type needles, plastic coloured handle with tube. Yellow, 0.18mm (diameter) × 30 mm (length) with tube: used on face and body points. Lime green, 0.14mm (diameter) × 15 mm (length) with tube: used specifically around the mouth, forehead, and neck.

**Patient Treatment and Result:** The author decided to use the CFA protocol on the patient to see how much progress could be made with the surgically-induced facial paralysis. Motor point stimulation on the right side of the patient's face never elicited a gripping action, indicating that the neuromuscular junctions were no longer functional. However, muscle tone improved, indicating that the facial muscles' ability to contract was still functional when stimulated externally, i.e., manually and electrically, through electroacupunture, ENAR, and Facial Gym Exercises.

### Electroacupuncture

An ES 160 Stimulator was used to provide EA. **Output Modes:** Eight modes - constant, burst, surge, fast/slow, sweep - and three random programs. **Frequency:** 0.3-500Hz. **Voltage setting:** 6, 12, or 21 volt. **Phase duration:** 50-400µs, adjustable. **Amplitude Electroacupuncture:** High 0.32mA ± 25%. Low 0-16mA ± 25% (peak). **Pulse shape:** Symmetric, bi-phasic square pulse.

**Needles for CFA origin/insertion technique and EA:** Origin and insertion technique with electro acupuncture. Seirin L type needles, metal handle with tube, 0.20mm (diameter) x 30mm (length).

**Patient Treatment and Result:** Average treatment was 30 minutes duration. Treatments alternated among the five output modes of constant, burst, surge, fast/slow, and sweep. The origin/insertion protocol is the method of choice for EA using the CFA protocol as it can be used to target a specific muscle. The aim was to achieve visible muscle twitching within each treatment, and in most treatments this was achieved.

### Facial Gym Exercises

The patient was taught a technique called Facial Gym Exercises taught by Mary Elizabeth Wakefield in the CFA seminars. In this protocol the patient places her fingers on the muscle chosen and then contracts the muscle against the resistance of the fingers. The patient in this case adapted this technique to the right side of her face, pulling the non-functional muscles in the direction they would follow if she had normal facial movement. The chosen muscle is contracted for six seconds, and the contraction is repeated ten times. (Wakefield & MichelAngelo, Non-needle modalities, 2015).

**Patient Treatment and Result:** The patient performed these exercises twice a day. She was compliant with this treatment; however, in the early stages she had to practice in front of a mirror. She found this emotionally challenging as it brought home the extent of her paralysis. Over two and a half years her facial muscle tone improved, and this improvement has been maintained. It also, along with the ENAR, enables her to take a very active role in her progress.

### Auriculotherapy

As in other microsystems, in auriculotherapy the whole body is holographically represented in the ear; complex systemic conditions can be treated with ear acupuncture. There are different schools of ear acupuncture. Auriculotherapy, from the French tradition, uses the Vascular Autonomic Sign (VAS). The VAS is a particular pulse quality which indicates when an active point has been found on the ear. Another technique of auriculotherapy treats internal and external toxic scars, which can be barriers to healing (Chalmers, 2014).

**Needles for Auriculotherapy:** Seirin J type needles, plastic coloured handle with tube. Lime green, 0.14mm (diameter) × 15 mm (length) with tube.

**Patient Treatment and Result:** The patient was treated for eight weeks in early 2017 using auriculotherapy techniques to treat internal scars around her brainstem and external scars around her right ear, which were incurred over a decade earlier when she had her original surgery. The aim was to eliminate all active points on the ear related to scars. Over the course of the eight weeks this was achieved.

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The patient had front treatments only due to her many medical issus.

### Hypnosis

The practitioner is a qualified hypnotherapist and occasionally supplemented acupuncture treatments with hypnotherapy.

**Patient Treatment and Result:** The patient responded well to the relaxation provided by hypnotherapy and also to the removal of psychological blocks to treatment.

### Other Modalities

The patient also performed home treatments, including use of an Electro Neuro Adaptive Regulator (ENAR) to maintain facial muscle tone, kinesiology, physiotherapy, ophthalmic appointments, and yoga.

**Patient Treatment and Result:** Facial muscle tone was maintained with ENAR during the two and a half years of treatment. Other modalities enabled the patient to actively engage in her progress and gave her relaxation, flexibility, and ongoing physical monitoring of progress. It was interesting to note kinesiology and acupuncture could not be given within 24 hours of each other as they increased her involuntary shaking and poor balance. A minimum of 48 hours between these modalities was maintained.

## Aims and Understandings of Treatment

- As the practitioner is a nurse and acupuncturist she was looking at the patient's issues from both a TCM and a WM perspective. This integrated approach helped deal with patient issues well over a decade old.
- The patient had front treatments only due to her many medical issues. She cannot lie on her face as it affects her breathing.
- The facial nerve comes out of the head at SJ 17 (*Yi feng*), so this acupuncture point has always been targeted.
- **Cranial Nerves:** Treatment progressed on the understanding that the operation report clearly stated that the right-sided facial nerve had been severed during surgery in 2003, the right-sided trigeminal nerve had been damaged but was still intact, and the vestibulocochlear nerve had been utterly destroyed. Treatment commenced in 2014 with the practitioner thinking she did see a tiny movement in the right corrugator muscle, giving the client a tiny frown. The

hope was that the apparent tiny amount of residual movement in the right corrugator meant that a tiny strand of CN7 might have been left intact, and that acupuncture could help nerve regeneration along both CN7 and CN5. By 2016 the movement in the corrugator was obvious.

- **Facial Muscles:** Motor point treatments aimed to elicit visible muscle twitching at the motor end plate. Unfortunately the patient never had this response, implying that the motor end plates were no longer functional.
- Whilst the logic of needling into obviously flaccid paralysed facial muscle with possible muscle fibrosis and atrophy, fused motor end plates, and CN7 dymelination with axonotmesis could be questioned, so could the logic of not even trying. Mayor (2007), however, stated that in neurotmesis (complete denervation), when muscle no longer has any motor points and muscle fibres have to be stimulated directly, stimulation of the muscle itself will maintain nourishment to the tissue. Facial muscle tone did improve with external muscle stimulation treatments from MA, EA, ENAR, and Facial Gym Exercises. This is elaborated upon in the section below entitled "Discussion and Future Directions for Treatment."
- The right gracilis nerve graft was not specifically targeted for acupuncture during the course of these treatments, as the aim was to try to obtain facial movement in her natural facial muscles. However, it would have been needled many times during the last few years whilst using the CFA protocols on the patient's natural facial muscles as it overlaid many of these muscles. The patient's use of the grafted muscle has become more spontaneous during the course of treatments. This development is discussed below in the sections entitled "Objective Changes in Motor Response as Shown by Photos" and "Discussion and Future Directions for Treatment."
- **MA and EA:** MA and EA commenced with strong treatment for a chronic condition as recommended by Mayor (2007). Although EA was used in continuous mode on occasions, the main modes used were burst, surge, fast/slow, and sweep with alternating frequency levels, though the aim was a high frequency of 50-200 HZ. The goal with EA was always to elicit visible twitching of the muscle and to obtain some awareness of sensation in the patient's face. This was usually achieved.
- The treatment has been ongoing for two and a half years. This is a long time; however, the research indicates that the longer the face has been paralysed, the less optimistic the outcome (Mayor, 2007). The case history by George (2017), for example, showed that treatment on the damaged but still intact facial nerve had been ongoing for a year.

# Course of Treatment

### December 2014 and July 2015

Between December 2014 and July 2015 treatments were performed weekly for an hour. Body points chosen included the eight extraordinary master/couple points and points to calm the liver and remove phlegm. During this period the CFA motor points were used and supplemented with auricular acupuncture. Specific muscles of the face were targeted. These included the epicranius, the orbicularis occuli, the risorius, the mentalis, and the depressor labii inferioris. Treatments alternated among the forehead, eye, cheek, and mouth. In May of 2015 Facial Gym Exercises were introduced to be performed twice a day for five minutes.

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### September 2015 – April 2016

Between September 2015 and April 2016 treatments were performed weekly for an hour. Body points chosen continued to include the eight extraordinary master/couple points and points to calm the liver and remove phlegm. During this period the CFA motor points to target the muscles above were still used; however, the origin/insertion technique was commenced and targeted the buccinator, the depressor labii inferioris, and the depressor anguli oris. One muscle would be treated with electroacupuncture, and an alternate muscle would be treated with motor point treatments. Occasionally bilateral facial treatments were used. The facial exercises continued.

### May – September 2016

Between May and September 2016 the weekly one-hour treatments continued. Body points chosen included the usual points to remove phlegm and calm the liver; however, now the Windows of the Sky and body points were included according to the CFA protocol. Facial muscles chosen included the corrugator, the buccinator, the digastricus, the mentalis, and the depressor anguli oris. Electroacupuncture using the CFA origin and insertion techniques was used mainly on the buccinators and the mentalis.

### September 2016 –June 2017

Between September 2016 and June 2017 treatments were performed twice a week for an hour per treatment. Doubling the treatments enabled the various techniques to be alternated. Body points were used to calm the liver and remove phlegm. They also included the eight extraordinary master/couple points and the Window of the Sky points. The use of electroacupuncture with the origin and insertion technique continued. Facial muscles targeted included the epicranius, the occularis oculi, the corrugator, the risorius, the buccinator, the depressor anguli oris, and digastricus. Electroacupuncture primarily concentrated on the epicranius, the buccinator, the risorius, and the depressor anguli oris. Other facial muscles were treated with the motor point treatments. Auriculoacupuncture to treat the toxic scars caused by the original brain surgery continued for eight weeks from January to March 2017.

## Results

### Sensory and Subjective Changes

Sensory changes are subjective and difficult to chart. The sensory nerve endings in the skin for finger pressure and needle sensation differ. Light pressure is transmitted to the brain via the A-beta skin nerve fibre, and a pinprick sensation is transmitted to the brain by the A-delta skin nerve fibre (Corradino, 2017).

The patient's right-sided trigeminal nerve was damaged, however still intact; and she still had sensation on the right side of her face. The patient could always feel finger pressure anywhere on her face (A-beta skin nerve fibre). Needle sensation, however, tended to be felt on the outer edge of her face (A-delta skin nerve fibre). As the needles progressed towards her nose, needle sensation was random and unpredictable. Between December 2014 and July 2015 she reported such changes as an increased ability to feel needles in her face and to feel gravy on her chin. Between May and September of 2016 she reported sensations of cheek tightening and increased sensation around her mouth as well as more facial sensitivity to needles. Between September 2016 and June 2017 these improvements continued with a subjective report of increased sensation when undertaking her facial exercises as well as improved ability to hold water and food in her mouth when eating or brushing her teeth.

The subjective sensations in her body were totally unpredictable and were not the main focus of the treatments. However, she did mention she feels she is getting more control of her body's internal temperature. The patient is prone to feeling cold, despite living in a very warm climate.

People's observations of the patient in her general life are encouraging. Family members and friends state that her face has gained more mobility during the course of the treatments, that her speech has improved, and that she seemed to be walking more quickly. Her ophthalmologist commented that her right eye is closing better and that her vision has improved. Her family doctor has also commented that her face is "looking good."

The intensive MA and EA and facial exercise regime seemed to be stimulating CN5 in some way, especially as concerns conduction along the A-delta fibre. Only a nerve conduction test could give an objective measurement of nerve impulse along the trigeminal nerve. This was performed in October of 2017, and the results will be discussed in the section on "Discussion and Future Directions for Treatment."

## Objective Changes in Motor Response as Shown by Photos

***Only the photos showing obvious muscle changes were included.***

**Resting Face:** August 2015 vs June 2017. Right-sided facial muscle tone has increased.

*August 2015*

*June 2017*

**Right Sided Facial Muscle Tone:** August 2015 vs June 2017. A close up on the right side of the patient's face shows more definition of the cheek bone and increased muscle tone.

*August 2015*

*June 2017*

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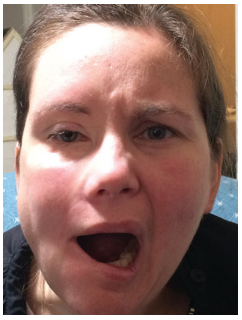
**The smile [Muscle - Levator labii alaeque nasi (Wakefield, 2014); Innervation - the zygomatic and buccal branches of the facial nerve (Mayor, 2007)]:** August 2015 vs June 2017. The patient's smile has marginally increased as shown by a slight indentation around her mouth on the right side of her face. This result could also have been due partly to the increasingly spontaneous use of the right-sided grafted gracilis muscle, as this muscle was grafted near ST 4 (*Di cang*).

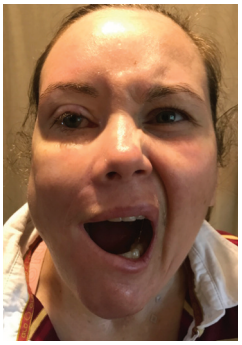
*August 2015*

*June 2017*

**Mouth opening [Muscle - complex interplay of various muscles such as the risorius, levatator labii alaequi nasi, zygomaticus major, etc. (Wakefield, 2014); Innervation - the zygomatic, buccal, and mandibular branches of the facial nerve (Mayor, 2017)]:** September 2015 vs June 2017. The patient is able to open her mouth more fully. This result could also have been due partly to the increasingly spontaneous use of the right-sided grafted gracilis muscle.



*September 2015*



*June 2017*

**The frown [Muscle - corrugator supercilii (Wakefield, 2014); Innervation - the temporal branch of the facial nerve (Mayor, 2017)]:** September 2016 vs June 2017. The patient now has developing ability to frown on the right side of her face. Although the practitioner was wondering if the corrugator muscle was working in 2015, it was not until June of 2016 that it became obvious.

*September 2016*

*June 2017*

**The smile with the grafted gracilis muscle:** August 2015 vs June 2017 vs January 2018. Between 2015 and 2018 the facial tone around the inserted gracilis muscle has increased; and controlled use of the graft has markedly increased. This has given a new direction for treatment as discussed in the section below entitled "Discussion and Future Directions for Treatment."

There are two comparison videos of the patient talking in April and October 2015, and also two comparison videos of her talking in January and August 2016. Whilst there is not much difference between the comparison videos in the same year there is a definite improvement between 2015 and 2016. The patient's lower left mouth has visibly more movement with less straining of the left lower mouth muscles to accommodate speech.

*August 2015*

*June 2017*

*January 2018*

* *Photos from the author's collection are reproduced with the permission from the patient.*

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### Overall Changes According to the House-Brackmann Scale

**Facial Movement:** At the beginning of treatment in December 2014 facial movement on the House-Brackmann Scale was at level 6 – total paralysis. In June 2016 there seemed to be a flicker of movement in the inner right eyebrow. By early 2017 the patient's right inner eyebrow showed increased movement, indicating a change from level 6 to level 3. By early 2017 the right corner of her mouth showed slight movement, also indicating a change from level 6 to level 3. However, some of this movement could be attributed to the increasing ability of the grafted gracilis muscle to elicit spontaneous movement at the corner of her mouth.

**Facial Tone:** At the beginning of the treatment, facial tone scored a 5 - 6 on the House-Brackmann scale – at rest the face was asymmetrical. By mid 2017 right-sided facial tone had increased to a level 3 – an obvious but not disfiguring difference between the two sides and, at rest, normal symmetry and tone.

Wakefield states that the corrugator muscle in the inner corner of the eyebrow controls the ability to frown; and the movement of this muscle conveys suffering, anger, concentration, impatience, or depression (Wakefield, 2014). Whilst the patient dealt with the consequences of surgery with as much fortitude as she could, much of her internal feelings over the intervening years covered this gauntlet of emotions. Perhaps it was not ironic that this was the one muscle on the paralysed side of her face which began to work spontaneously.

## Discussion and Future Directions for Treatment

In October 2017 the patient went for a nerve conduction study on her face for CN5 and CN7.* As there was no record available from a NCS done in 2003, there was no comparison baseline. The results showed CN5 was conducting impulses, albeit at half the level of the left side of her face. The right-sided CN7 NCS showed no motor response, indicating the nerve was non-functioning. The neurologist made no specific comment about her ability to frown on the right side of her face using CN7 although he said there was some clinical recovery of facial function.

So what is happening? Treatment progressed initially on the assumption that a strand of CN7 on the right side was still functioning due to the movement in her right corrugator muscle. Perhaps magnetic resonance imaging (MRI) could now determine if this strand is still there. This could be investigated further. The increased movement near ST 4 (*Di cang*) on the right could be attributed to the nerve graft from 2004 pulling on the right side of the patient's mouth.

Although an assumption has been made by the practitioner that the motor end plates of most of the facial muscles on the right side of the patient's face are fused (as the motor points never reacted), the facial muscles themselves have regained tone, indicating the muscle can still contract when stimulated electrically by a mechanical device or moved forcibly with facial exercises.

Where do all these findings and assumptions then direct the path of future treatments? The patient will continue with Facial Gym Exercises and her ENAR machine to keep the right facial muscles toned. CFA and EA will still be used on the temporal branch of the right facial nerve to increase the frown, and treatments will be given to stimulate recovery of CN5. As a baseline NCS has now been performed, any future improvements can be measured. The microsystem of auriculotherapy will now be directed towards treating the sequelae of the stroke by targeting lesions in the brainstem. Magnetic acupuncture therapy is also being considered.

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* *Permission given by the patient to view the NCS report.*

The focus of EA is now to work with what WM has left her – the curious situation of a functioning nerve graft on the right side of her face to elicit a smile. The use of this graft to smile is not fluid as it requires a conscious clenching of her teeth to initiate the muscle contraction; and, by the time she has done this, the left side of her face has already finished the smile. The clenching of the teeth works against a spontaneous expression of happiness, too! The aim is to try to elicit this muscle contraction as quickly and unconsciously as the natural left-sided smile.

# Conclusion

Research with both MA and EA shows improvements can be made to the motor movement of the facial muscles of expression when CN7 is damaged by viral infection or trauma. This is the case even when this nerve is partially severed through trauma or surgery, as acupuncture can help the nerve regenerate. However, when the nerve is totally severed, it will have to be surgically repaired for nerve impulses to pass along the nerve pathway again. From a TCM perspective physical structures need to be intact for Qi and blood to flow normally. Immobilisation of the face is seen as a stagnation of Qi and blood complicated by internal patterns of phlegm, liver Qi stagnation, and eventually liver and kidney yin deficiency. Research shows MA can aid nerve regeneration in the PNS, especially if combined with other modalities, especially electroacupuncture.

At the age of 22 years old, the patient had a right-sided acoustic neruoma surgically removed. With no medical intervention the neuroma would have been fatal. Not only did she suffer from the most extreme outcome of this surgery with total right facial paralysis and deafness, but she also had a brain stem stroke during the operation, leaving her with left-sided body paralysis. Over the next few months she underwent extensive rehabilitation in the hospital system, and in the intervening years she had two facial muscle and nerve grafts. Further treatments included stem cell therapy, acupuncture, kinesiology, ENAR, yoga, and hypnosis.

In December 2014 the acupuncture treatment regimen commenced and concentrated primarily on restoring whatever right-sided facial movement was possible using her natural facial muscles, as research shows that damage to CN7 is the most distressing outcome of this surgery. The treatment regimen comprised a variety of methods including Mary Elizabeth Wakefield's Constitutional Facial Acupuncture using motor points and electroacupuncture using the origin and insertion technique. The patient also undertook the Facial Gym Exercises from the CFA seminars. Further interventions included the microsystem of auriculotherapy concentrating on treating the external and internal surgical scars around her right ear. The treatment protocols as described in this article continued for two and a half years between December 2014 and July 2017. From July 2017 to the present day she is undergoing therapy with revised aims which are not the subject of the present article.

Objective improvements were analysed using the House-Brackmann Scale of Facial Movement and photographs. There was an increase in facial muscle tone, movement in the right corrugator muscle, and movements around ST 4 (*Di cang*). Subjective improvements included reports of holding food in her mouth more effectively and various people commenting that her face looked improved. Future treatments will now concentrate on ongoing CFA treatments with the right corrugator muscle to elicit more movement and ongoing Facial Gym Exercises and the use of the ENAR machine to maintain the increased muscle tone. New directions in therapy will include the use of auriculotherapy as a microsystem to target the sequelae of the stroke, magnets on chosen CFA acupoints for stimulation of Qi and blood, and the integration of more fluid muscle movements using her gracilis muscle graft when she is smiling. This is now being achieved with facial muscle training and hypnosis. Her treatments continue.

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