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Case report

Electrical current and acupuncture treatment for a paediatric patient with a recurring long thoracic nerve paralysis

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ABSTRACT

A female paediatric patient aged 9 years presented with right long thoracic nerve palsy for the second time. The first injury that occurred in 2011 was due to a fall and although the patient had a paralysis of the serratus anterior muscle and was unable to elevate the arm, with rehabilitation and conventional physiotherapy, she recovered completely according to the nerve conduction test that was conducted six months post recovery.

The second injury to the long thoracic nerve was due to a ballet movement that occurred in 2012. Besides the nerve palsy that reoccurred there was also a complication of severe pain and evidence of a complex regional pain syndrome (CRPS). The second injury was limited by the inability to participate in rehabilitation exercises and physiotherapy due to pain and hyperaesthesia in the distribution of C5 and C6 dermatome both in the trapezius and shoulder region. The third nerve conduction test deteriorated to those recorded after the first nerve conduction test.

A different physiotherapy approach was then applied – initially to reduce pain and decrease hyperaesthesia and then to attempt to *increase* nerve conduction by the inclusion of an electrical device that simultaneously delivers both a low and a high frequency current. This treatment was *combined* with various pain resolving tactics including acupuncture, individual sub-liminal, low and high frequency electrical currents. Several interventions were applied to tailor the treatment to the patient to achieve maximal improvement in pain and mobility. It is therefore difficult to attribute improvement to one particular modality or even natural resolution of the condition however previous clinical application and experience of activating nerve conduction with the combination current in other conditions implied that improvement could be expected. This particular electrical current is a combination of a low frequency and a magnetic field.

The condition resolved completely with full movement and no pain after 13 treatments over two months – it was evident that *the combination* of treatment had an effect on expediting the healing in the nerve. The patient was able to resume all her normal activities including gymnastics and ballet.

1. Background

Most patients diagnosed with long thoracic nerve injury with a resulting paralysis of serratus anterior may only recover after two years. The fact that the paediatric patient mentioned in this case history was able to recover within two months was unexpected and seemed remarkable. It has been discovered that a recently developed non-interventional high frequency current has been able to stimulate a nerve root, plexus or branch nearest to a nerve injury with rapidly improving strength occurring in the compromised muscle. This has been illustrated clinically in patients with Bell's palsy. It is noteworthy that faradic current, transcutaneous electrical nerve stimulation (TENS) and galvanic type current cannot be expected to accelerate normal nerve conduction in this type of neuropraxia.

2. Literature review

The first report of the non-interventional pulsed radio frequency device was made by T Goroszeniuk and S Kothari on "External Stimulation: Simplistic Solution to intractable pain?" at the Pain Management Centre, St. Thomas' Hospital, London in 2009. A prototype of the device called the Neurotrace III was used on 35 patients with peripheral neuropathic pain. Three treatments were given once weekly for 5 min per treatment and there were no negative results, with 19 patients achieving 100% improvement. The second report given by a physiotherapist from Pretoria, South Africa by DA Muller in 2010 on a patient with left sided Bell's palsy that had

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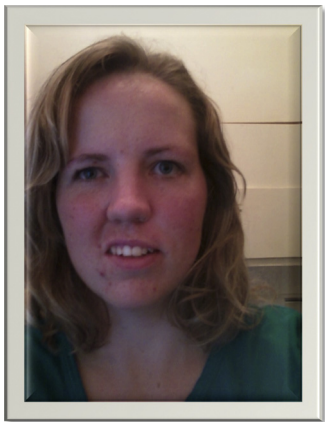

Fig. 1. A left sided Bell's palsy patient, after 6 months with no further recovery.

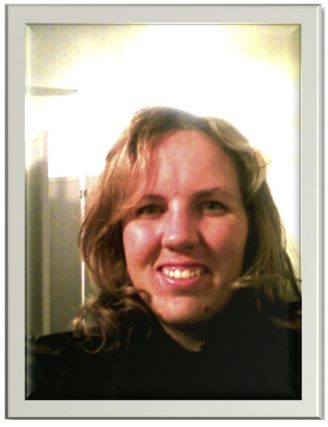

Fig. 2. The same patient after one month of non-interventional pulsed radiofrequency.

not resolved after six months. The neurologist advised that no further treatment would improve the condition. The physiotherapist commenced normal treatment of ultrasound, laser, electrical stimulation and facial exercises three times weekly from 26 February until 13 May with no change in the left facial muscles. Muller then gave her patient the above-mentioned non-interventional pulsed radiofrequency device to use at home once a day for 5–10 min on the left facial nerve branches. By the end of June, most left facial muscles improved from 0/5 to 3–4/5 on the Oxford Grading Scale, except for orbicularis oculi that only reached 2/5 and the eye could not close completely (Figs. 1 and 2).

Since 1936 according to Ginsberg [1], ultrashort radio waves have been used as a therapeutic agent. Lombardo [2] presented information at the Symposium at the Ginsberg Foundation for Medical Research 1959 on the treatment of decubitus ulcers with radiofrequency. Jeran et al. [3] published their results on the effects of low frequency pulsing electromagnetic fields on skin ulcers of venous origin in humans: a double blind study. Al-Badawi et al. [4] in 2012 recorded the efficacy of pulsed radio frequency energy in temporomandibular joint pain and dysfunction. However all the previous types of non-interventional pulsed radiofrequency treatments did not involve contact with a probe on a nerve root, plexus or branch but rather were either placed adjacent but not on the body area or used electrodes that may have been strapped near the offending area to be treated.

Van Zundert et al. [5] found in a study on a rat model that pulsed and continuous radio frequency adjacent to the dorsal root ganglion induces latent cell activity via the upregulation of c-fos mRNA. This may have implications for nerve stimulation and possible regeneration.

Fig. 3. The appearance of the scapular in this patient on the second occurrence of the long thoracic nerve injury and paralysis, October 2012.

3. Case report

3.1. Presenting history and complaint

A nine years old female was referred on 25 October 2012 to a physiotherapy practice for pain management and rehabilitation after being diagnosed with long thoracic nerve compression with paralysis for the second time and with the added complication of complex regional pain syndrome according to the referring rheumatologist. This second injury was caused by holding hula-hoops during a ballet class while practicing for a concert.

When the condition appeared in the first week of October the patient was referred for conventional physiotherapy that consisted of: biokinetics with exercises, physiotherapy with both active and passive movements plus interferential electrical current stimulation and hydrotherapy.

These treatments increased stress and pain. As pain and hyperaesthesia became a major issue and all attempts to mobilize and strengthen the shoulder became impossible, it was then decided that conventional physiotherapy should cease and that pain management commence, to break the pain cycle. This non-interventional pain management included various electrical currents and acupuncture.

4. Objective examination

Winging of the scapula was evident (Fig. 3).

There was severe pain from the right lateral cervical region from C4/5 referring to the right shoulder both anteriorly and laterally (deltoid region).

The area was hyperaesthetic with a red flare/erythema of discolouration mainly in the neck when touched or even if the patient was distressed by the *thought* of having the shoulder touched or moved.

The patient held her right upper arm close to the chest with the elbow flexed. There was full movement of the right forearm, hand and fingers but nil active movement of the shoulder in all ranges. The scapular winged noticeably, the right upper trapezius muscle was depressed with the cervical spine tilted to the right with 50% limitation of right rotation of the cervical spine.

Assessment of pain at the first consultation 25-10-2012.

Visual analogue scale (VAS): best is 7.5/10, worst 10/10.