Using the ODFS as part of Physiotherapy Treatment Sessions

The use of the ODFS as an orthosis to aid walking through correction of dropped foot is well known. However it can also be a useful tool in the re-education of some of the more proximal problems that may occur during gait. Electrical stimulation may act to produce a movement that has been lost and strengthen weak muscles, to reduce spasticity through reciprocal inhibition of antagonist muscles or to provide a sensory feedback cue for movement. There may also be a combination of one or more of these effects. The ODFS can be controlled by the therapist using the test button, thus enabling the stimulation to be timed exactly to the needs of the patient, independently of weight being placed on or taken off the footswitch. Alternatively, footswitch control can be used, leaving the therapist's hands free to control or facilitate movement where required. The ODFS can be used to stimulate a number of muscle groups other than the anterior tibial muscles in order to re-educate the components of gait most relevant to the individual patient. In the initial stages of gait re-education it can be useful to isolate a particular component of the gait cycle and work on it using stimulation to initiate or reinforce movement at the correct stage. Patients should always be positioned so that they feel secure, well aligned and with as even weight distribution as possible.

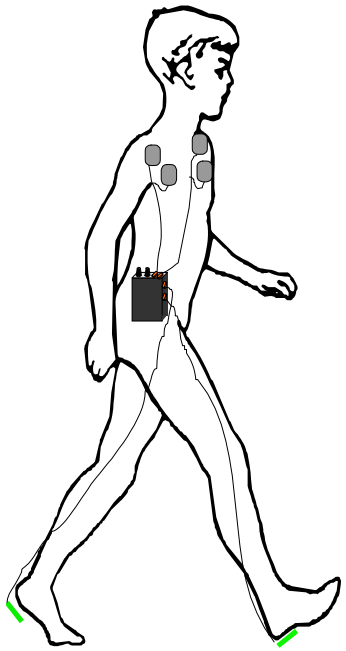
Below are some of the ideas that we have tried.

Retraining the swing phase.

The patient wears the stimulator but the footswitch is detached so that the therapist can control the timing of the stimulation. The patient stands with the non-hemiplegic leg forward of the hemiplegic and is asked to transfer weight over the non-hemiplegic leg allowing the hip and knee of the affected side to drop whilst the opposite knee remains straight. Stimulation of the common peroneal nerve controlled using the test button can be used to help initiate the swing phase on the hemiplegic side as the patient begins to transfer weight. Once this has been achieved the patient is asked to take a full step with stimulation timed to allow the leg to swing forward freely. Normal selective movement is encouraged through repetition of the movement, reducing the need for proximal compensatory strategies such as 'hip hitching' and circumduction to aid toe clearance from the ground. The same procedure can be used in reverse for backward stepping. Use of the footswitch allows patient control of the stimulation and leaves the therapist's hands free to control more proximal movement if necessary.

Practising weight bearing through sensory input

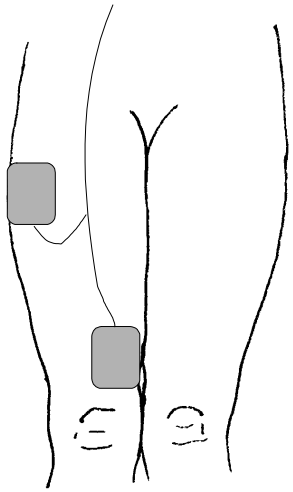
The sensitivity of the footswitch can be utilised to encourage weight bearing and weight transference to the affected side. Using standard dropped foot electrode positions, the footswitch under the heel on the affected side and the stimulator set to heel rise, the patient can be encouraged to transfer weight through the hemiplegic side by the need to turn off the stimulation. Since the stimulation is acting primarily as a sensory cue in this situation, the precise electrode positions may not be important. This idea has been developed to provide proprioceptive awareness for patients who have little or no sensation in the affected side but reasonable motor function. One such patient has common peroneal nerve stimulation with the stimulator set on heel strike and the footswitch under the heel of the hemiplegic side. She is then able to feel her foot on the ground as she walks. Another patient has had electrodes placed on a sensate part of the body, for example the shoulder. Sensory feedback is given when the foot is on the ground. This can also be done bilaterally using the 02CHS.

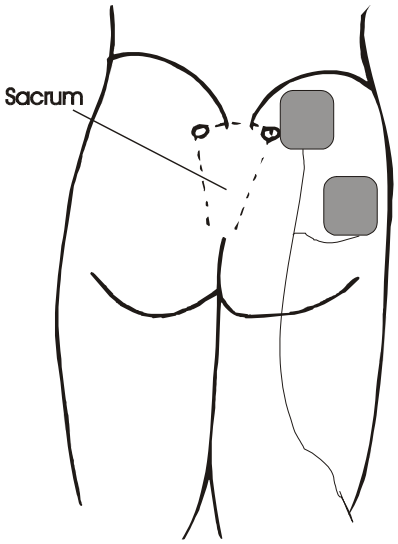


Practising weight bearing through stimulation of quadriceps and gluteal muscles.

The quadriceps and or gluteal muscles can be stimulated to give patients greater confidence in placing weight through the hemiplegic side. For quadriceps stimulation 70mm electrodes are placed with the active over the motor point of vastus lateralis and the indifferent over the motor point of vastus medialis. The ODFS is set to heel strike and the foot switch placed under the heel on the affected side. The patient is asked to transfer their weight to the affected side in standing, the therapist giving manual guidance and support as necessary. It may be necessary to increase the TIME control fully to maintain the stimulation for the maximum time and to use a moderate RISING EDGE RAMP to give a smooth comfortable contraction, thus avoiding increased spasticity and possible hyperextension of the knee.

Patients who exhibit retraction at the hip or who have weakness and instability at the pelvis may benefit from stimulation of the gluteal muscles during weight transference in standing to improve alignment and reduce the tendency for the knee to hyperextend during weight bearing. Electrode positioning will vary depending on whether more hip extension or abduction is required. The active electrode is placed adjacent to the sacrum over gluteus maximus and the indifferent about a hand's width below and lateral to it over gluteus medius. This is generally the best position for hip extension. If a greater influence of abduction is required reversing the polarity of the electrodes will increase the effect of gluteus medius. Stimulation begins, eliciting hip extension, as weight is placed on the

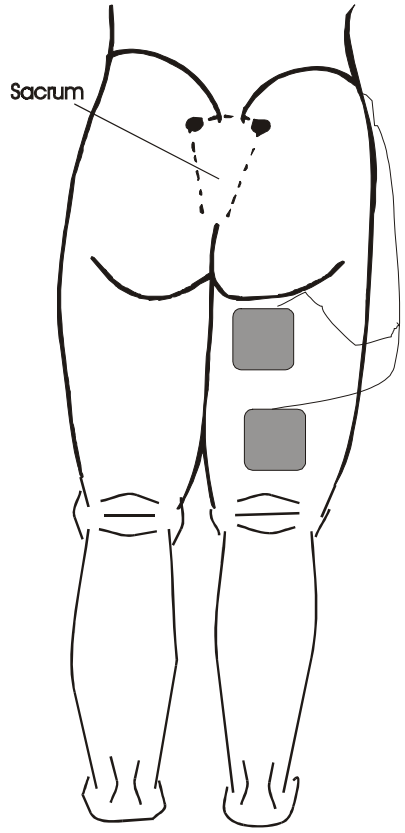




footswitch set on heel strike on the affected side. In some cases the sensation of stimulation in this application may become uncomfortable before a muscle contraction occurs. However, the sensation may act as a cue to remind the patient of the need to activate the muscle themselves, comparable to manual facilitation of movement from the therapist. With a foot switch under the heel of the effected side set the ODFS to heal strike. This will cause the stimulation to occur throughout the stance phase. There has been some recent success with an incomplete spinal cord injured patient who developed some active hip extension after only one month's daily use of gluteal stimulation with the ODFS. An O2CHS will be needed if dropped foot also has to be corrected. If electrodes are to be worn for any length of time ensure that pressure marking cannot occur from sitting on electrodes or cables.

Stimulation for 'push off'

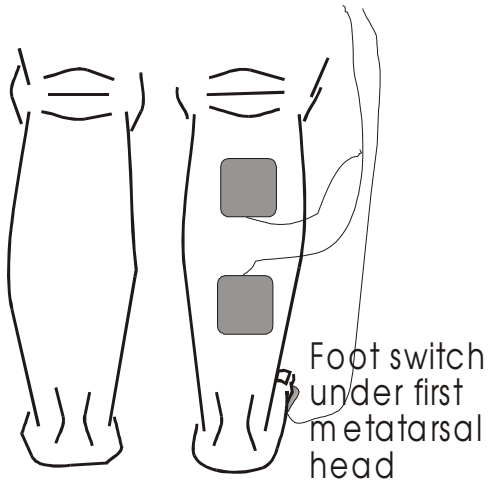
The calf muscles can be stimulated to improve 'push off' and therefore forward propulsion at terminal stance, to put some 'spring' back into the walking pattern. The active electrode is placed over the belly of the muscle with the indifferent a hand's width below it. Either 50 or 70 mm electrodes can be used depending on the size of the patient. When used in gait, stimulation is best controlled with the footswitch placed under the first metatarsal head. If some RISING EDGE RAMP is used stimulation starts at mid stance and addition of some extension allows the stimulation to continue until the toe leaves the ground. A sounder is useful to help judge the exact timing of the stimulation.



Encouraging release of the hip and knee to initiate swing – hamstring stimulation

It is frequently difficult for hemiplegic patients to achieve selective release of the hip and knee when initiating the swing phase of gait. Stimulation of the hamstrings will often help to address this problem and prevent the 'hip hitching' that so often occurs. Stimulation can either be triggered manually using the test button or by a footswitch placed under the heel and set on heel rise so that the patient triggers the stimulation himself, leaving the therapist free to control or facilitate movement proximally or distally. When using a foot switch, set the time quite short so the stimulation ends at mid swing, allowing the knee then to extend.

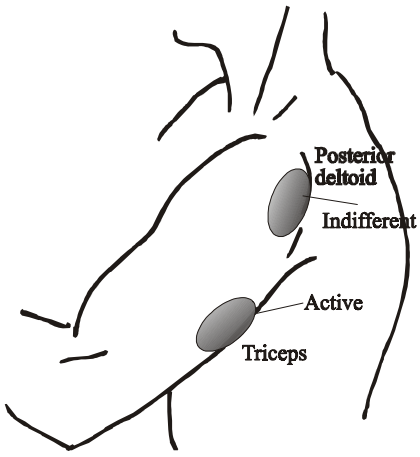
If a second ODFS is available, common peroneal stimulation can be used to correct dropped foot in the usual way, triggered by a footswitch and the hamstrings can be stimulated using the test button. This enables hamstring stimulation to be timed to the exact point it is needed in the gait cycle. As well as assisting with gait initiation it may be used to break quadriceps spasticity, particularly at mid to terminal stance, when many patients find it difficult to release their knee sufficiently to allow the leg to clear the ground during swing phase, often resulting



in hyperextension of the knee. Alternatively, the hamstring muscles may be too weak to produce effective knee flexion to mid swing and hamstring stimulation from early to mid swing may be helpful. Electrodes are placed with the indifferent 2-3 finger widths above the knee crease with the active a hand's breadth above the indifferent.

Inhibition of associated reactions in the upper limb during gait

This is not an application that we use very frequently. However, it can be effective in some cases.
It is well known that the effort of walking often produces associated reactions into flexion in the hemiplegic upper limb. Stimulation of the triceps and posterior deltoid muscles timed using a footswitch on the affected side and set to start on heel rise and end on heel strike can extend the arm and encourage it to swing. This can improve balance during walking. The active electrode is placed over the belly of triceps and the indifferent over the posterior deltoid muscle.



These are some of the ideas we have tried. They can all be used to improve the gait pattern in conjunction with common peroneal stimulation using a 02CHS. However, the ODFS on its own can be a very useful tool with which to practise selected components of gait which are a specific problem for an individual patient. It is hoped that practice in such a way will promote a more automatic and natural gait pattern, which, as a result, requires less effort to achieve. We should be very happy to hear of any other applications for the ODFS that you may have devised during physiotherapy treatment sessions, so that we can pass on your ideas and add to our own knowledge.

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