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Letter to the Editor

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Muscle stretching for treatment and prevention of contracture in people with spinal cord injury

A lot was made in this thoughtful article by LA Harvey and RD Herbert about contractures post spinal cord injury. The authors mention their study of stretching the joints of recently injured patients using a strict protocol on a carefully controlled spinal cord injured (SCI) population. No statistical evidence for treatment efficacy was found, a factor which surprised them.

A recent review[1] showed that in neuromuscular conditions, immobilisation, muscle weakness, paralysis, or spasticity are the main factors that can cause contracture. In the SCI population, the factors are muscle imbalance and consequent lack of joint motion with resultant abnormal positioning which is compounded by spasticity. This imbalance changes essential elements in the equation: the muscle itself, especially at microstructure level and the surrounding connective tissues are altered. A further consequence is articular cartilage degeneration in arthrodial joints. These factors lead to deformity which complicates rehabilitation. Harvey and Herbert note a decrease in sarcomere numbers and changes in alignment of connective tissue but the importance of considering all the elements of the contracture equation cannot be too greatly stressed. The emphasis in the text is on passive stretching as the treatment, without the critical conclusions being drawn about *which* elements of the target tissue (muscle cell and supportive tissue) require treatment. Stretching was shown to prevent the loss of sarcomeres when an otherwise immobilised mouse limb is taped into a stretched position for 30 min per day.[2] There are additional changes which need to be addressed which were not identified by the authors. These include the relatively increased proportion of connective tissue within a muscle[3] and the increase in cross bridges within the connective tissue[4] which are factors which reduce the extensibility of the structure.

There is a description of stretching and positioning techniques but no appraisal of recent orthotic developments to treat contractures. Bonutti *et al*[5] and Gelinas*et al*[6] use incrementally adjustable orthoses to stretch elbow contractures. Keeping and Major,[7] Charlton *et al*[8] and Bromwich *et al*[9] describe early encouraging results using a dynamic orthosis (the contracture correction device, CCD) which uses a gas spring to provide a continuous stretch. A further dynamic system (Ultraflex) has been developed in the USA and is reported to have been used to successfully reduce elbow contractures in a C5-C6 tetraplegia.[10]

Augmentations to positioning, physiotherapy, and use of orthoses should be noted as possible other treatments – namely Functional Electrical Stimulation and the use of Botulinum toxin injections.

In animal studies Goldspink and Goldspink[11] showed improved rabbit muscle weight when stretching is combined with electrical stimulation. Williams *et al*[12] showed that with electrical stimulation there was no connective tissue accumulation. Thus muscle atrophy and connective tissue accumulation can be prevented in animals by the use of stretching and electrical stimulation. Pandyan and Granat[13] showed some reduction in human wrist flexion contracture when treated with functional electrical stimulation after stroke and Gibson *et al*[14] prevented muscle atrophy with electrical stimulation in immobilised limbs.

Cosgrove and Graham[15] used spastic mice, injecting botulinum toxin into gastrocnemius of one limb and noting that that limb did not develop contractures as occurred in the non-injected limbs of both the experimental and control mice. Further work in children with cerebral palsy has shown that when spasticity is relieved by these injections contractures can be reduced.[16] Other researchers note improvements in adult passive range of motion when botulinum toxin is used.[17,18]

We acknowledge the difficulty in assembling all the relevant scientific evidence and hope that our additional points are of interest. The evidence from animal studies[2] and work with cerebral palsy[19] should we think be used in conjunction with the results from Harvey and Herbert's own study[20] to question the efficacy of passive stretching as a realistic way of managing contractures. We can perhaps avoid 'the labour intensive traditional manual stretching techniques' by utilising more than just condition–specific knowledge of pathology. Whilst stretching of a simple contracture may still be feasible, any more involved contracture with spasticity or any other predisposing factors is likely to involve more than one joint segment. Such cases are common and should be approached using a wider armamentarium. The pathophysiology of contracture has to be understood by all who wish to manage the condition to give treatment-appropriate focus. We suggest contemporary treatment modalities can be integrated into regimes which should then be evaluated in SCI and other units dealing with contractures.

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