
The present review describes several age related changes in the neuromuscular system of humans and animals which may underlie the marked strength decline of ageing muscle. Studies describing the effects of resistance training on the muscle strength of ageing humans and animals are also reviewed. From a survey of these studies, the strength decline with age appears to be due, in part, to a loss of muscle mass. While not conclusive, the effect of resistance training has been to attenuate the extent of the atrophy occurring with age, and to improve strength. A better understanding of the neuromuscular mechanisms of ageing, as well as the adaptive response of ageing mammalian muscle to resistance training, could enable physical therapists to critically evaluate the merits of strength training intervention for improving the physical ability of an ageing individual.

Keywords: Aging; Exercise; Muscles


The paper examines the factors which influence physiotherapists' decisions to practise geriatrics. Some 233 physiotherapists returned a questionnaire aimed at identifying the major issues which affected work preference. The questionnaire included items on previous work experience with older people, attitudes towards ageing and elderly clients, and professional issues which influence career choice.

The results indicated that most physiotherapists preferred to work in areas other than geriatrics. The majority who practised geriatrics were females aged 41-65, employed part-time. The decision not to work in geriatrics appeared to be related to lack of work experience with older people and employment conditions. Greater negative bias towards elderly people was shown by physiotherapists without postgraduate education in gerontology. In addition, there was a perception amongst clinicians that gerontological physiotherapy offered few opportunities for professional advancement and lacked status.

Keywords: Attitude of Health Personnel; Geriatrics; Physical Therapy


The purpose of this study was to investigate the outcome of rehabilitation following cerebrovascular accident (CVA) in one Sydney unit. This unit has implemented a philosophy of training based on a motor learning model for rehabilitation proposed by Carr and Shepherd (1987a and 1987b). The proposed motor learning model stresses the need for task and context specific training of everyday actions. Data, including patient characteristics and Motor Assessment Scale (MAS) scores, were collected through a retrospective audit of all patients diagnosed as having a CVA and discharged from the unit during 1989. The major finding of this study was that, following rehabilitation within a multi-disciplinary program, patients were able to improve their motor performance as demonstrated by changes in MAS scores. The measurement of outcome of rehabilitation for this unit has contributed to quality assurance by identifying motor tasks that warrant further emphasis in
training in order to improve upon the reported outcome of rehabilitation.

Keywords: Cerebrovascular Disorders; Motor Activity; Program evaluation; Rehabilitation


This pilot study was undertaken to determine the effectiveness of a strapping technique to prevent the onset of shoulder pain in the hemiplegic upper limb of patients following a cerebrovascular accident (CVA). Eight patients with no voluntary movement in their hemiplegic upper limb were selected for inclusion within 48 hours of their admission to hospital: Four subjects were assigned to a strapping group and four were assigned to a non-strapping group. Each subject was assessed daily for the presence of shoulder pain utilising the Ritchie Articular Index, adapted for use with hemiplegic patients by Bohannon and LeFort (1986). The number of pain free days for each patient was recorded and a comparison made between the two groups. Results indicated that subjects in the strapping group experienced a significantly longer pain free period (mean = 21 days) compared with the non-strapping group (mean = 5.5 days). This pilot study demonstrated that strapping the affected shoulder following CVA did delay the onset of shoulder pain. However, further investigation with a larger study population is required to evaluate the effectiveness of the strapping technique against other factors.

Keywords: Cerebrovascular Disorders; Pilot projects; Shoulder


This study was designed to investigate the relationship between step time and step length in a healthy population of young adults. The sample was composed of 10 females and 10 males with ages ranging from 19 to 25 years. The subjects walked along a resistive grid walkway at an audio-controlled cadence of 80 steps per minute. These trials consisted of two walks with asymmetrical step lengths (2/4 time), two walks with asymmetrical step times (3/4 time) and two in which the only constraint was the cadence. The results indicate that the values of average velocity and average step length can be used to calculate step time with reasonable accuracy in a symmetrical walking pattern, but not under conditions of induced step length or step time asymmetries. It is suggested that stride frequency rather than cadence be used, particularly when measurements are made from patients with asymmetrical walking patterns.

Keywords: Gait; Reproducibility of Results; Walking


This double blind, controlled study compared the changes in pain, stiffness, circumference and range of movement, produced by one 30 minute application of High Rate TENS, or strong Burst Mode TENS on chronic osteoarthritic knees. Both TENS applications were applied at strong, tolerable intensities for 30 minutes, over four acupuncture points around the knee. Pain, stiffness, circumference, and range of movement measurements were recorded immediately before and after the TENS applications.
Length of continuation of pain relief and alteration in stiffness was reported by subjects. The study aimed to establish whether strong Burst Mode TENS produced significantly greater and longer lasting changes than those produced by High Rate TENS. The only significant change produced by strong Burst Mode when compared with High Rate TENS was on knee circumference.

Keywords: Double-blind Method; Knee; Osteoarthritis; Transcutaneous Electric Nerve Stimulation


Peer review is a quality assurance tool which offers much to physiotherapists in the 1990s. It continues to be valuable when practised in both formal and informal settings. Over the last decade, peer review has been developed into several formalised processes, enabling physiotherapists to choose the most appropriate method of peer review to suit their mode of practice. The result is an opportunity for physiotherapists to share ideas for improvement in all aspects of physiotherapy practice in a non-threatening, positive environment.

Keywords: Peer Review; Private Practice; Quality of Health Care


Twenty four uninjured female volunteers (mean age = 19.6 years) were utilised to study the effect of modified Gibney ankle strapping on proprioception before, during and after exercise, by measuring performance on an instrumented wobbleboard. Following a familiarisation session, testing was conducted on two occasions using a crossover research design, utilising strapped and unstrapped conditions. The time in contact, the number of contacts and the average time in contact that the wobbleboard made with a metal baseplate under the wobbleboard were recorded during a 10-second test duration. Tests were conducted at the times of 0, 5, 10 and 15 minutes of a standardised exercise regime performed by the subjects. Results revealed that strapping had no significant effect on wobbleboard performance. Since the wobbleboard is widely accepted as a method of training as well as a clinical assessment of ankle proprioception, it could be inferred that strapping had no effect on proprioception before, during or after exercise.

Keywords: Ankle; Kinesthesis; Sports Medicine


In order to investigate the blood pressure and heart rate responses to a standard lower limb isokinetic test, 19 subjects between the ages of 20 and 30 were measured prior to, immediately post-exercise, and for four minutes into recovery. Although no direct comparisons were available, these values were found to reflect cardiovascular responses consistent with those seen in maximal treadmill testing. In addition, correlation studies demonstrated a non-significant relationship between systolic blood pressure and heart rate at all stages. Similarly, no significant relationship was found using scales of distress or perceived exertion. The implications of these findings are
discussed in conjunction with relevant cardiovascular stress testing literature. Clinical recommendations include the implementation of a standardised screening procedure, a supervised cool-down phase and standard stress-testing precautions when undertaking maximal isokinetic testing.

**Keywords**: Cardiovascular System; Exercise; Muscle Contraction


Active protection of the lumbar spine is important in prevention of back strain during exercise. This EMG study investigated three common techniques used for lumbar stabilisation: posterior pelvic tilt, lower abdominal hollowing with lumbar spine flattening and abdominal bracing. The aim was to determine which method encouraged the best stability pattern. Muscle activity was measured in obliquus abdominis, upper and lower rectus abdominis and the lumbar erector spinae. Standardisation of muscle activity against that during maximally resisted trunk rotation (already shown to illustrate an appropriate stability pattern) allowed comparisons between exercise techniques in relation to their stabilisation pattern. Results indicated that posterior pelvic tilt demonstrated the least desirable stability pattern. Both abdominal hollowing and bracing provided a more suitable pattern.

**Keywords**: Abdominal Wall; Exercise; Spine


The load-displacement-time characteristics of the lumbar spine were obtained under simulated central posteroanterior (PA) mobilisation. The instrumentation (the spinal mobiliser) consisted of a motor-driven force applicator and a pair of displacement transducers. The PA mobility of the L3, L4 and L5 segments of 28 young normal subjects (14 males and 14 females) was examined, and this was found to be dependent on spinal level but not on gender. At each level tested (except L5), greater movement was observed in the more caudal of the two segments adjacent to the mobilised vertebra. Finally, L4 was subjected to cyclic and sustained PA loadings, and to loadings at different rates. Viscoelastic behaviour such as creep and rate dependency was observed, as was the preconditioning phenomenon. The results suggest that PA mobilisation produces more mechanical effects on the lower segment, and that the preconditioning and creep effects might explain the improvement in spinal mobility after mobilisation.

**Keywords**: Biomechanics; Physical Examination; Spine


Recently there has been increased interest in the use of isokinetic exercise by physiotherapists both in scientific research and clinical practice. Isokinetic exercise can be used for the assessment of muscle performance and for the treatment of impaired muscle performance. Fundamental to the use of isokinetic exercise is the establishment of reliable test protocols for each joint tested to ensure that the isokinetic measurements obtained from the several commercially available isokinetic
dynamometers can be reliably reproduced. This paper reviews the literature available on the test-retest reliability of isokinetic torque measurements.  

Keywords: Exercise; Muscle Contraction; Reproducibility of results


The purpose of this study was to determine the change in some kinematic characteristics of standing up as patients recovered following stroke. Patients who have had a stroke resulting in a diagnosis of hemiplegia, but with no other involvement, were videotaped on two occasions; when they could first stand up independently and again when they could stand up and sit down three times in 10 seconds with no observable asymmetry. A kinematic analysis yielded angular displacement and velocity data from the affected hip and knee joints. The results indicate that the kinematic characteristics that changed significantly as the subjects improved their ability to stand up are related more to velocity than to angular displacement. Movement time decreased, peak angular velocities increased and the velocity profiles shifted towards normal. This implies that in the clinic, once a patient can stand up independently, improvement on this task will be promoted if motor training includes strategies that affect these temporal characteristics.  

Keywords: Cardiovascular Disorders; Motor activity; Rehabilitation


One of the major reasons for admission to an intensive care unit is haemodynamic instability. It is important for physiotherapists to recognise and predict haemodynamic instability when planning intervention in these patients. This paper reviews the existing literature on haemodynamic effects of physiotherapy in ventilated intensive care patients. Recommendations are made for further research, including multi-centre documentation, attainment of normal data and single case studies in this area.  

Keywords: Intensive Care; Physical Therapy; Respiration, artificial; Ventilation


Hyperinflation is a compensatory mechanism which occurs in response to increased resistance of the airways. Hyperinflation allows for an increase in minute ventilation and improves the efficiency of the inspiratory intercostals. However, there are detrimental effects on the function of the diaphragm and the accessory muscles, which increase the work of breathing. The physiotherapist's initial goal is to enhance the action of the respiratory muscles and not to select strategies that will interfere with this compensatory mechanism. Once the underlying problem is stabilised, the physiotherapist may then use strategies which assist with the reversal of the problem.  

Keywords: Lung Diseases, obstructive; Physical Therapy; Respiratory mechanics
Despite the growing interest in the role of the inspiratory and accessory muscles of respiration in chronic respiratory disease, few therapists have considered the role sleep may play in the deterioration of a patient's clinical condition. A number of important physiological changes to respiration occur during sleep, which affect chest wall mechanics and gas exchange. The ensuing abnormalities caused by sleep hypoventilation and fragmentation can severely affect daytime function and wellbeing. Nocturnal nasal positive pressure ventilation (NIPPV) is now established as an effective means of preventing such changes in patients with chest wall and lung disease. Therapists involved in pulmonary rehabilitation programs must recognise the potential for nocturnal respiratory events to severely affect daytime function and understand the importance of reversing nocturnal respiratory failure in order to maximise the rehabilitation potential of patients. 

Keywords: Apnea; Respiration, artificial; Respiratory Muscles; Sleep; Ventilation

In this study of 39 patients with severe chronic airflow limitation, an independent group design examined the effect on exercise performance of a six-week program of leg muscle training, inspiratory muscle training and postural drainage. Exercise performance was reassessed at three months after the completion of the training program. MANOVA analysis of the 12-minute walking distance test showed a significant training effect ($< 0.001$) with the largest effect occurring with leg muscle training (873 to 952 metres), a placebo response with postural drainage (886 to 925 metres) and minimal change with inspiratory muscle training (911 to 920 metres). There was a carry over effect at three months with leg muscle training, that was not seen in the other groups.

Keywords: Exercise; Lung Diseases, obstructive; Rehabilitation

The influence of exercise rehabilitation on quality of life in patients with cardiac pathology, chronic airflow limitation and healthy controls was investigated. Eleven patients with cardiac pathology, 12 patients with chronic airflow limitation and 10 healthy controls participated in the research. They completed self-efficacy and happiness questionnaires prior to and following eight weeks of supervised exercise conditioning. Results demonstrated a significant improvement in physical efficacy in patients with cardiac pathology and chronic airflow limitation but not controls. Emotional efficacy improved significantly in healthy controls and patients with chronic airflow limitation but not those with cardiac pathology. Happiness was unchanged in all groups.

Keywords: Exercise; Rehabilitation; Self Concept

Respiratory muscle (RM) EMG was recorded in 10 healthy adults during bilateral and voluntary
unilateral inspiration. Each performed bilateral and unilateral inspiration at 50, 75 and 100 per cent of maximal inspiration (PI max) measured with a mouth pressure gauge. The obliquus externus abdominus (EAO) EMG was also recorded in five subjects. Results showed that RM and EAO activity on the expanding side was similar during all levels of effort. The RM activity on the non-contracting side during most submaximal efforts was higher than that on the same side during bilateral efforts but not during maximal effort. The increase in EMG could be due to cross-talk from EAO and latissimus dorsi, or co-activation of the internal intercostal muscles. Because RM activity at PI max was similar for unilateral and bilateral efforts, it was concluded that voluntary unilateral RM inhibition may not be possible during maximal effort.

Keywords: Electromyography; Muscle Contraction; Respiratory Muscles


This study compared the peak expiratory flow rates (PEFR) at different inspiratory pause pressures (IPP) produced by the Mapleson-C circuit and the Laerdal self-inflating resuscitator. The difference in PEFR produced by the two circuits was significantly different at the lowest and the highest IPP studied (13 and 38cm H2O). The greatest differences in the mean expiratory flow rates produced was, however, only 0.07 litre sec^{-1}. The authors suggest that the choice of bagging circuit should depend on the experience and familiarity of the therapist with the circuit.

Keywords: Peak Expiratory Flow Rates; Respiration, artificial; Ventilation


At the Royal Perth Hospital, pain during physiotherapy range of movement and muscle stretching exercises has been a significant problem for some patients who have had polyradiculoneuritis, otherwise known as the Guillain-Barre Syndrome (GBS). Anxiety often accompanies GBS and can exacerbate the experience of pain. Regular analgesics have failed to adequately control the patients' pain such that full range of movement has been impossible and soft tissue shortening has occurred. Recently, alternative pain control in the form of hypnotherapy has been used during physiotherapy sessions. Two case studies are presented as examples of the use of hypnotherapy at the Royal Perth Hospital. These describe the benefit of hypnotherapy for pain control in some patients who have GBS.

Keywords: Hypnosis; Pain; Physical Therapy; Polyradiculoneuritis


Peripheral tissue pathology causes a rapid and enduring increase in the excitability of spinal cord neurones. This review examines some of the basic and clinical research which suggests that the central nervous system is capable of making a contribution to clinical signs and symptoms. Mechanically produced clinical responses of pain and movement behaviour may not always be indicative of their source or cause. Certain implications for physiotherapy are discussed. The actual systemic effects of mechanical stimuli, as used clinically by physiotherapists, need to be investigated.

Australian physiotherapists have been encouraged to collect, interpret and use information related to spinal stiffness during the assessment and treatment of patients with spinal pain. This paper discusses some problems surrounding the interpretation of stiffness data and suggests an alternative approach to clinical practice that does not rely upon these tests. A review of the literature currently available suggests that considering stiffness may hinder rather than help treatment selection and patient management.

Keywords: Backache; Decision Making; Physical Examination; Reproducibility of Results


A study is reported in which 20 healthy subjects performed a non weight-bearing aided gait with elbow crutches. The crutches were adjusted to a conventional height and also to heights 2cm and 4cm above and below this setting. Temporospatial and kinetic data were acquired and the results indicated that no significant differences were demonstrated for most parameters across the various height settings. Only at the setting 4cm above conventional was there a significant increase in the abduction moment at the shoulder joint. The conclusion of the study was that height adjustment of elbow crutches with this gait was not a critical issue except at a height 4cm above the conventional setting, and that the subjective impression of the user regarding comfort was a good indicator of correctness of fit.

Keywords: Biomechanics; Crutches; Gait


The term minor instability refers to a condition in which chronic microtrauma involving the stabilising mechanisms of the glenohumeral joint leads to subluxation of the humeral head. The condition is commonly associated with athletes involved in repetitive high-velocity activities such as throwing or swimming. Minimal signs are found on physical examination of the shoulder joint but the patient presents with vague pain, catches of pain, apprehension with overhead movement or an impingement-like condition which appears resistant to treatment. The clinical examination findings which might alert the physiotherapist to the potential diagnosis of minor instability are reviewed. Following this, an approach to management with emphasis on establishing muscular control in the early stages of rehabilitation is presented.

Keywords: Diagnosis, differential; Exercise therapy; Physical Examination


The title of this review can be interpreted in two ways, reflecting the stage of development of
knowledge regarding the neuromuscular events during short duration stretching of normal muscle. If current scientific theories are accepted as the truth, then the truth needs to be stretched a little to explain the findings from clinical trials in normal human subjects. Recent studies have shown quite high levels of electromyographic (EMG) activity in muscle undergoing stretching and also that proprioceptive neuromuscular facilitation (PNF) relaxation techniques actually increase EMG activity, yet paradoxically result in greater gains in range than those obtained from passive stretching techniques. These findings limit the somewhat simplistic notion of muscle relaxation during stretching, to achieve intramuscular connective tissue elongation.

Keywords: Exercise Therapy; Muscle Relaxation; Neurophysiology


Osteoarthritis is a common disabling joint disease frequently resulting in considerable pain and discomfort. Although some progress has been made in terms of medical therapies designed to reduce osteoarthritic pain, the limitations of these therapies emphasise the need to explore alternative approaches to osteoarthritic pain management. This report summarises the major mechanisms of pain production in osteoarthritis and discusses the potential use of those exercises commonly used by physical therapists for relieving the pain associated with this disease. It is concluded that, in view of our limited understanding of the mechanisms of osteoarthritic pain production and the paucity of studies demonstrating the efficacy of exercise for reducing osteoarthritic pain, further basic and clinical research in this area is warranted.

Keywords: Mechanoreceptors; Osteoarthritis; Pain


Twenty boys aged between eight and 12 years were studied to determine the reliability of using an isokinetic dynamometer (Kin-Com) in evaluating shoulder rotation and to assess the relationship of anthropometric measures to isokinetic strength. Using a repeated measures design, each subject was asked to work the internal and external rotators of the glenohumeral joint of the dominant upper extremity concentrically and eccentrically at two speeds in random order on two separate occasions. Results showed no significant differences between the strength data collected on the two occasions. Internal rotators were found to be significantly stronger than the external rotators and the eccentric strength was significantly greater than the concentric strength. A significant relationship between the anthropometric measures (age, height and lean body weight) and the isokinetic strength was also demonstrated.

Keywords: Child Development; Muscle Contraction; Shoulder Joint