
Selected Abstracts

MUSCULOSKELETAL PHYSIOTHERAPY AUSTRALIA

14th Biennial Conference

POSITIVE PRECISE PERFORMANCE



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AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

*Musculoskeletal Physiotherapy
Australia*

Introduction

For the first time, Musculoskeletal Physiotherapy Australia has provided online publication of abstracts presented in oral format at the MPA Biennial Conference, 2005.

The major theme of the MPA Biennial Conference was: **Positive Precise Performance**. The three words in the theme are interchangeable and can be linked or may stand-alone. Essentially, musculoskeletal physiotherapy offers consumers positive outcomes through the performance of precise diagnostic procedures and management approaches.

The 2005 Conference continued the tradition of showcasing the latest research in musculoskeletal physiotherapy under the four major sub-themes of the conference:

- Pain
- Lower limb function
- Motor control
- Future directions in musculoskeletal physiotherapy.

Pain related to the cervical and lumbar spines was the focus of a number of abstracts. Other pain-related topics include neurogenic pain, outcome measures, and management approaches.

MPA 2005 showcased recent research regarding lower limb function and approaches to management of various pathologies influencing lower limb performance. Foot biomechanics and orthotics were also included under this theme.

Motor control is an evolving area of research with major impact on the delivery of physiotherapy. Recent developments in this area challenge the clinician to consider the effect of dysfunction on the entire system rather than the affected area in isolation.

Musculoskeletal physiotherapy needs to conduct regular 'health' checks to ensure that the profession is able to move forward in a positive and productive manner. The profession also needs to project what it will like to look like in perhaps twenty years from now—will services be the same? How will management styles evolve? The 'Future Directions' sub theme was a welcome opportunity to explore some of these issues.

The abstracts in this electronic publication provide a unique insight into the high standard and broad scope of presentations at the MPA Conference in 2005. The Committees involved in organising the conference congratulate all presenters on the high quality of their submissions which make this conference a significant event on the professional development calendar!

Louise Wellington

Scientific Convenor, MPA 14th Biennial Conference 2005
Australian Physiotherapy Association

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FUTURE DIRECTIONS

Innovations in musculoskeletal practice: Using ethics to enhance clinical communication that facilitates obtaining patients' informed consent to all treatments

Delany C

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The aim of this study was to examine the communication between physiotherapists and their patients in private practice settings, and to highlight how the content and structure of the interaction compares to the ethical and legal ideals and expectations of communication required to obtain patients' informed consent to treatment. The qualitative study involved audio-taping single treatments of 17 private practice treatment encounters, and conducting semi-structured interviews with participating physiotherapists. Grounded theory methodology was used to analyse the transcript data. This involved the development of descriptive themes from within the data, a process of constant comparison between thematic categories of communication content and style, and the development of a theoretical model of the clinical interaction. The model demonstrated a structured biomedical approach to clinical communication that valued patient trust and co-operation. Tacit or implicit consent was routinely obtained in these physiotherapy treatments. Although dynamic and flexible, the model grounded in the data did not align with ethical and legal models of clinical interactions, which incorporate patient collaboration and require more explicit practices of seeking and obtaining consent within interactions. Knowledge of how the content and structure of clinical communication potentially affect the process and ideals of obtaining patients' informed consent to treatment provides an essential first step in enhancing and identifying more effective communicative strategies between patients and physiotherapists. Innovations to communicative practice are proposed to improve the alignment between ethics and clinical practice with a view to facilitating patients' informed consent to all treatments.

Early identification of patients at risk of persistent musculoskeletal problems: Development and validation of the musculoskeletal Generic Screening Tool

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The study aim was development and validation of a psychosocial Generic Screening Tool (GST) for evaluation of the risk of chronicity in musculoskeletal compensable patients and determination of effectiveness in identifying poor prognosis. Development utilised the Guyatt three-stage process with item generation and reduction enabling face, content, and construct validity producing a final tool that was effectively a modified Orebro Musculoskeletal Pain Questionnaire (OMPQ) with critical differences in five areas. Subsequent validation was performed with a prospective trial using a physiotherapy population sample of convenience from 10 Australian physiotherapy clinics (n = 153) that employed four subgroups for the determination of

tool characteristics and psychometric properties. The GST and OMPQ demonstrated test-retest reliability (n = 12) with respectively $r = 0.945$ and 0.965 ($p < 0.001$) and criterion validity (n = 50) $r = 0.992$, $p < 0.001$. Predictive capacity (n = 103) was determined by the time required to achieve 80% pre-injury Global status with a logarhythmic correlation at $p < 0.001$ for all analysis with the total data pool $r = 0.85$ and sub-categorisation favouring lumbosacral ($r = 0.89$), cervical ($r = 0.84$), upper limb ($r = 0.79$), and lower limb ($r = 0.69$). A subgroup (n = 61) demonstrated specificity and sensitivity for absenteeism (91% and 87%), total cost (93% and 94%) and days to closure (78% and 75%) at GST 110-points cutoff. The GST is clinically reliable and valid for predicting poor prognosis in musculoskeletal compensable patients.

Specialisation in musculoskeletal physiotherapy: At the crossroads

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Musculoskeletal Physiotherapy Australia (MPA) has a proud history both nationally and internationally of leading the profession in postgraduate education and formal recognition of advanced clinical skills. Any Australian Physiotherapy Association member may join MPA at Level 1 and it is anticipated that most Level 1 members would eventually progress to Level 2 (titled membership). Level 2 members are recognised as clinical experts in musculoskeletal physiotherapy and mentors for Level 1 members aspiring to develop their expertise. However the viability of Level 2 membership as a source of growth and leadership for MPA, and as a stepping-stone to clinical specialist status, is now questionable. In 2005 a survey of Australasian universities revealed there are only 46 Australian students enrolled across the nine MPA-accredited programs from which Level 2 members are drawn. The limited success in progressing Level 1 members to Level 2 is also evident in the fact that in 1999 there were 733 Level 2 members, yet only 744 in 2005. Essentially there has been no real growth in the number of physiotherapists with recognised postgraduate qualifications in musculoskeletal/manipulative physiotherapy. Although the reasons for the reluctance of Level 1 members to undertake postgraduate study have not been researched, it is likely that the costs of education (both real and opportunity), the lack of remunerative reward and a relatively inflexible educational pathway have all contributed. MPA now offers an alternative pathway to Level 2 membership but more is needed if clinical specialisation in musculoskeletal physiotherapy is to be realised successfully.

Validity of the Doppler velocimeter for pre-manipulative screening of vertebral artery blood flow

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Neurovascular incidents associated with cervical manipulation are commonly attributed to compromise of vertebral artery blood flow. Manipulative procedures involving rotation in the neck may reduce blood flow in the vertebral artery contralateral to the direction of rotation. Pre-existing compromise of one or more vertebral arteries is considered a contraindication to neck manipulation. Current pre-manipulative screening protocols are limited in their assessment of vertebral artery flow and may not adequately identify those at risk. It has been proposed that the use of a continuous wave ultrasound device (velocimeter) may assist in identifying patients presenting with flow abnormalities. The aim of this study was to determine the validity and reliability of the use of a velocimeter in detecting abnormal vertebral artery blood flow. Blood flow in the atlanto-axial segment of seated healthy adult volunteers (n = 60) was examined in the neutral and end-range contralateral neck rotation positions. Duplex ultrasound scans were performed and identified 17 volunteers (28.3%) with abnormal flow according to pre-determined criteria. Three trained physiotherapists blinded to the duplex examination results then used a velocimeter to examine the vertebral arteries of the volunteers. The specificity of the velocimeter examination to detect abnormal flow identified by the duplex examination was fair to good (range 0.78–0.87). However, its sensitivity was poor (range 0.25–0.38) and the inter-examiner reliability was poor ($\kappa = 0.21$). This study indicates that examination of vertebral arteries with a velocimeter is not a valid or reliable tool for the detection of abnormal blood flow in vertebral arteries.

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LOWER LIMB

Specific changes within the gluteus maximus muscle but no change in tensor fascia lata in patients with osteoarthritis of the hip

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Therapeutic exercise is an essential component of management and prevention strategies for osteoarthritis. Specificity of exercise prescription is a topic of ongoing debate. The aim of this study was to determine if there are specific and differing changes in muscles around the hip in the presence of osteoarthritis. Magnetic resonance imaging was used to determine hip muscle volumes in 12 subjects with either mild ($n = 6$) or moderate to severe ($n = 6$) unilateral osteoarthritis of the hip, and 12 age and sex matched normal control subjects. The difference in hip muscle volumes between the affected and unaffected hip in the pathology group, and the left and right hip in the control group was assessed. There were no significant differences in muscle volumes between sides in the normal control group. Gluteus maximus was analysed both as a whole muscle and also in its functionally separate parts, upper and lower gluteus maximus. The group with more severe hip osteoarthritis revealed a significantly smaller muscle volume on the affected side for gluteus maximus as a whole ($p = 0.00$), and for the upper ($p = 0.00$) and lower portions ($p = 0.03$) when analysed separately. The volume of gluteus maximus as a whole, and the upper portion of gluteus maximus, showed no significant difference between affected and unaffected sides in the mild group, however the lower portion was significantly smaller ($p = 0.01$) on the affected side. Tensor fascia lata showed no significant difference in muscle volume between affected and unaffected sides for either the group with mild ($p = 0.31$) or severe hip joint pathology ($p = 0.69$). This study highlights the importance of considering stage of pathology and specific muscle changes when developing therapeutic exercise programs. Specific changes that reflect both muscular atrophy and hypertrophy around one hip would support the view that specificity of exercise prescription is required for optimal effectiveness of prevention and management programs.

Static alignment of the knee in patients with knee osteoarthritis is associated with increased knee joint loading in gait

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The peak external knee adductor moment (KAM), one measure of dynamic knee joint loading, is implicated in the progression of medial knee OA. Previous studies have reported that static lower limb alignment is associated with the magnitude of the peak KAM. The aim of this study was to evaluate whether a varus alignment was associated with a higher peak KAM. Forty participants (24 female, 16 male) with medial knee OA underwent 3D gait analysis (1 m/s). Knee joint kinetics and kinematics were measured using a 6-camera VICON 612 motion analysis system, and

two AMTI force plates, using the Plug-in-Gait model. The peak KAM (N.m) was determined for the stance phase and normalised to body weight (BW) and height (BH). Alignment was taken as the intersection of the mechanical axes of femur and tibia on full leg X-ray. Based on the median score, the participants were divided in two groups, one with a more varus mean alignment (170 degrees) and one with a more neutral mean alignment (178 degrees). Mean (SD) KAM was 4.13 (0.71) %BW*BH for the varus alignment and 3.41 (0.92) %BW*BH for the neutral alignment group ($p = 0.008$). A varus alignment is associated with a higher peak KAM. Therefore, conservative interventions should be aimed at reducing a varus knee alignment. Such interventions include knee braces or foot orthoses. These may reduce the KAM, and ultimately, slow the progression of medial knee OA.

Motor unit synchronisation is reduced in patellofemoral pain

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Patellofemoral pain (PFP) is a common problem of multifactorial aetiology. A key factor has been argued to be poor patellofemoral joint control due to impaired co-ordination of the vasti muscles. However, data both support and refute this hypothesis. Changes in motor unit firing may provide more definitive evidence. Synchronisation is a measure of the near simultaneous discharge of motor unit action potentials (MUAPs) in separate motor units, and has been argued to contribute to co-ordination of the vasti muscles to control the patellofemoral joint. We hypothesised that synchronisation may be reduced in PFP. Recordings of single MUAPs were made from vastus medialis obliquus (VMO) and multiunit EMG recordings were made from vastus lateralis (VL). Averages of rectified and unrectified VL EMG recordings were triggered from the single MUAPs in VMO. Motor units in VL firing in association with the VMO motor units would appear as a peak in the VL EMG average. Data were compared to previous normative data. The proportion of trials in which a peak was identified in the triggered averages of VL EMG was reduced in people with PFP (38%) compared to controls (90%). Data for most subjects with PFP fell outside the mean and 95% confidence intervals for pain-free individuals. Notably, although 80% of subjects had values less than controls, 20% were within normal values range. These results provide new evidence that motor unit synchronisation is modified in the presence of pain and provide evidence for motor control dysfunction in PFP.

Role of Mulligan Fibular Repositioning Tape in the prevention of ankle injury in basketball

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The aim of this study was to determine the effect of Mulligan Fibular Repositioning Tape (FRT) on the incidence of ankle injury in male basketball players. A prospective controlled trial was conducted involving 125 basketball players. Participants were allocated in a manner of convenience

to the control (209 exposures) or intervention group (234 exposures) prior to each basketball session. Control participants were able to use prophylaxis excluding FRT, if desired, and intervention participants had the Mulligan FRT method applied to both ankles with non-stretch tape. This taping technique requires two 20 cm lengths of tape applied at an oblique angle to the distal end of the lateral malleolus. A posteriosuperior glide is applied to the fibula at the level of the inferior tibiofibular joint whilst the tape is wrapped around the tendoachilles and anchored above the initial tape attachment. After each basketball exposure, data were obtained on the presence of ankle injury and control subject use of prophylaxis. Four hundred and forty-three measured basketball exposures resulted in 11 ankle injuries. The intervention group sustained significantly fewer ankle injuries ($n = 2$) compared to the control group ($n = 9$) (Fisher's exact test, $p = 0.03$). The odds ratio of sustaining an ankle injury was 0.20 ($p = 0.04$, 95% CI 0.04 to 0.93) when taped with FRT and the numbers needed to treat was 23 in players with a history of ankle injury. This study has provided evidence supporting the prophylactic effect of FRT on ankle injury in basketball players.

Does ACL reconstruction restore normal knee kinematics?

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Failure of knee reconstruction to alter the incidence of osteoarthritis in ACL-injured knees may be because kinematics are not restored. This prospective study used MRI to measure tibiofemoral contact patterns pre- and post-reconstruction. Twenty subjects with ACL injury performed a leg-press, relaxed and against a 150N load. MRI recorded the tibiofemoral contact position at 15 degree intervals from 0° to 90° knee flexion. Surgical outcomes were measured by passive laxity using a KT1000, and a Cincinnati score. Testing was performed preoperatively, at 12 weeks, and 2 years postoperatively. KT 1000 showed a side-to-side difference of 5.1 ± 2.6 mm preoperatively, 2.5 ± 2.2 mm at 12 weeks, and 2.1 ± 2.3 at 2 years. Cincinnati ratings were 5 'fair', 5 'good', and 8 'excellent'. Loaded tibiofemoral contact patterns were not different from unloaded at any stage. Medial and lateral compartments of the knee were different ($p < 0.001$) for healthy and injured knees demonstrating the longitudinal rotation of the knee during flexion. Preoperatively, the tibiofemoral contact patterns for the ACL-injured knee were different to the healthy knee ($p = 0.01$). At 12 weeks postoperatively, there was no difference in the tibiofemoral contact patterns between the operated and contralateral knee ($p = 0.12$), nor at 2 years ($p = 0.91$). However, lateral compartment contact pattern of both reconstructed and healthy knees showed less posterior translation at 2 years. While knee reconstruction restored the tibiofemoral contact pattern to that of the healthy contralateral knee, both healthy and reconstructed knees showed decreased longitudinal rotation over time.

Eccentric muscle function of previously injured hamstring muscles changes while wearing a pelvic belt

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The aim of this study was to determine whether changes occur in isokinetic variables in hamstring-injured athletes while wearing a pelvic belt (Smiley Belt™). A cross-over pilot study was carried out in a laboratory setting. Isokinetic variables were determined of eight athletes (age 20–55) with previously injured hamstrings in the prone position on a KinCom™ isokinetic dynamometer. Two sets of three maximal concentric and eccentric knee flexion movements of the injured and uninjured legs were performed at 60°·sec⁻¹, one set whilst wearing a pelvic belt and one set without the belt. Subjects were randomised to wearing the belt during the first or the second set of contractions. The dependant variables were peak torque, angle at peak torque (APT), and total work between 0 degrees and 40 degrees knee extension. Wilcoxon signed ranks tests ($p < 0.05$) were used to determine whether differences existed in the dependant variables between the belt conditions for the injured and the un-injured limbs respectively. The mean APT during eccentric contractions of the injured limb was 16.25 degrees closer towards full extension ($p = 0.03$) whilst wearing the pelvic belt than without the belt. Mean total work during the final 40 degrees of eccentric knee flexion of the injured limb was 21.5% greater whilst wearing the belt than without the belt ($p = 0.02$). No other statistically significant differences were found between the belt conditions. Changes in neuromuscular control may explain the differences in isokinetic variables during eccentric contractions of the previously injured hamstring muscle while wearing a pelvic belt.

MOTOR CONTROL

Long-term overactivity in the abdominal oblique muscles after 8 weeks bed-rest: Implications for inactivity, lumbar spine stability and sedentary lifestyle

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Background: Sedentary lifestyle is common of western societies. Concurrently, low back pain (LBP) incidence rates are higher in these countries. The occurrence of LBP concurrent with a sedentary lifestyle may be associated with the long-term development of inactivity-associated muscle dysfunction. In order to examine this hypothesis, prolonged bed-rest studies provide an opportunity to examine musculoskeletal adaptation during and after inactivity in the absence of pain. This study examined the motor control of the abdominal oblique muscles during 8 weeks of bed-rest and at 1-year follow-up. **Methods:** 10 male subjects underwent 8 weeks of bed-rest with 1-year follow-up recovery as part of the European Space Agency's 'Berlin Bed-Rest Study' based at the Charité Campus Benjamin Franklin Hospital, Berlin, Germany. Electromyographic (EMG) activity of the external and internal oblique (EO and IO) muscles was measured during a rapid repetitive, knee movement task conducted in prone lying at four speeds: 50, 75, 100, and 125 flexion and extension cycles per minute. An electrogoniometer measured knee movement. Tests were conducted on the 1st, 4th, 13th, 27th, 41st, and 53rd days of bed-rest (BR) and also on the 3rd, 7th, 14th, 28th, 90th, 180th, and 360th days of follow-up recovery (R+). Root-mean-square (RMS) values were calculated in selected EMG epochs. Ratios of RMS values were calculated between each speed of movement (i.e. 75/50, 100/75, 125/100). Data were also pooled across days to form baseline (BR1), early bed-rest (BR4, BR13), late bed-rest (BR27, BR41, BR53), early recovery (R+3, R+7, R+14), and late recovery (R+28, R+90, R+180, R+360) 'date clusters'. **Results:** During bed-rest, the IO 125/100 ratio was increased (early bed-rest $p = 0.05$, late bed-rest $p = 0.03$). In recovery, the EO 125/100 ratio increased with time (early recovery $p = 0.08$, late recovery $p = 0.02$), the IO 125/100 ratio was similarly increased in early recovery ($p = 0.003$) and in late-recovery all IO RMS-ratios were significantly increased (125/100: $p = 0.02$; 100/75: $p = 0.02$; 75/50: $p = 0.02$). **Conclusion:** The strongest effect observed in this study was a long-term increase in the IO RMS-ratios in the months following re-introduction of weight bearing after bed-rest. We consider this to be indicative of overactivity. IO overactivity has also been observed in LBP subjects. These findings indicate that prolonged inactivity can have detrimental effects on the muscles of lumbopelvic support and represent a first-step in examining the effect of sedentary lifestyle on musculoskeletal health.

Inefficient muscular stabilisation of the glenohumeral joint in subjects with shoulder pathology: A motor control study

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Dynamic muscular control of the shoulder is essential for overhead sporting activities. Loss of this control is implicated in shoulder pathology and pain. Knowledge of the patterning and timing of contractions in these situations will give some insight into the muscle problems present and also the appropriate rehabilitation techniques. A study was conducted to investigate the effect of pain on the pattern of contraction of the shoulder muscles among two groups of throwers: competitive throwers with pain ($n = 12$) and a matched control group of throwers without pain ($n = 11$). Fine wire electrodes were inserted into supraspinatus, infraspinatus, and subscapularis and surface electrodes were attached to serratus anterior, upper and lower trapezius, anterior and posterior deltoid, pectoralis major, and latissimus dorsi. A reaction time task of rapid external rotation was performed in sitting. The reaction time (RT) and relative latency (RL) were analysed. In the control group, subscapularis was active significantly earlier than supraspinatus and infraspinatus ($p = 0.02$). In the pain group, the RT of subscapularis was found to be significantly delayed in comparison to the other ten muscles ($p < 0.001$). Latissimus dorsi was found to be activated significantly earlier ($p < 0.001$ RT; $p = 0.03$ RL) than the other torque producing muscles. The results indicate shoulder pain is associated with changes in the pattern and onset of contraction of individual shoulder muscles. These results are in line with inefficient muscular stabilisation of the glenohumeral joint by the rotator cuff, and have implications for rehabilitation protocols prescribed for overhead athletes presenting with pain.

Work-related neck pain: An investigation of the relationship between physical and psychosocial features in the female office worker

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International epidemiological studies indicate that the prevalence of occupational neck pain is 46–57%. Research of this nature demonstrates that the prevalence is greater in office workers than in manual workers and greater in female employees. The aim of this study was to investigate the relationship between neck pain and workplace physical and psychosocial characteristics of female office workers. A cross-sectional survey of 300 female office workers is currently being undertaken using self-report musculoskeletal and psychosocial questionnaires. To assess physical task demands, questions were based on recommended standards of workstation design. Neck pain and function were assessed using the Neck Disability Index and the Nordic Musculoskeletal Questionnaire. The workplace psychosocial environment was assessed with a range of indicators, including job demands, decision authority, skill discretion,

support from supervisors and co-workers, experiences with technology systems, customer relations, and self-identity through work. Several indicators of employee adjustment were also assessed: namely psychological distress, somatic symptoms and job satisfaction. Various organizations were invited to participate in the research with an overall response rate of 30% achieved for this study. This paper will present the results of a multivariate analysis to determine the correlation between workstation design, use of computer at home and work, and hours of work with the various psychosocial domains.

Correlation of multifidus size and function following back surgery for disc dysfunction

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Low back pain (LBP) and leg pain following disc surgery are a major cause of morbidity. Some authors have examined the effect of surgery on the surrounding muscle system and a positive outcome from surgery has been found to correlate with normal multifidus size. Whether there is a cause or effect relationship between pain and muscle function is difficult to ascertain due to a lack of longitudinal studies. This study aimed to investigate the relationship between multifidus size and measures of LBP recovery. The size of multifidus was measured bilaterally from L2–S1 in 19 male subjects booked to undergo laminectomy/discectomy. Ultrasound imaging was used to measure cross-sectional area pre-surgery, two weeks post-surgery, and at one year. Four self-report measures were also conducted and included pain (back and leg) (PVAS), disability (RMQ), and general health (SF-36). Pearson's correlation analysis indicated that the size of multifidus had a negative correlation with LBP prior to surgery but not with leg pain ($r = -0.49$). This effect was lost two weeks following surgery. At one-year the size of multifidus significantly correlated with leg pain but not LBP ($r = -0.49$). In regards to disability, the only significant correlation with multifidus size occurred at one-year. The size of multifidus had a negative correlation with disability illustrating that subjects with greater disability had smaller muscles. There was little correlation between multifidus size and general health. The results of this study provide evidence for rehabilitation programs that target multifidus retraining in patients who have undergone back surgery.

Lumbopelvic posture affects the automatic recruitment of the pelvic floor muscles in sitting

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Retraining of the pelvic floor muscles for treatment of urinary incontinence has been recommended since 1948. Unlike other striated muscles, pelvic floor muscles exhibit tonic activity at rest in all positions. Whether sitting posture affects pelvic floor muscle tonic activity is unknown. This paper aimed to measure pelvic floor muscle resting activity in different sitting postures. Eight parous women, asymptomatic of urinary incontinence, were recruited for the study. Bilateral surface EMG activity of pubococcygeus, obliquus internus abdominis, and obliquus

externus abdominis was measured in slump supported, upright unsupported, and very tall sitting. The results indicated significant changes in pubococcygeal activity from slump supported to upright unsupported sitting ($p = 0.01$), and from slump supported to very tall sitting ($p = 0.004$). Activity in the internal and external obliques also increased but did not reach significance. These findings have implications for maintaining good pelvic floor muscle health in women.

Changes in co-ordination of human locomotor and respiratory movement in low back pain

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Introduction: Human locomotor and respiratory movements are co-ordinated in a manner that may assist mechanical control of the trunk. Foot-strikes (moments of high spinal impact) are minimised during phases of respiration when trunk muscle activity is reduced (due to respiratory modulation) and the trunk less stable. Furthermore, foot-strikes are maximised when trunk muscle activity and trunk stability are increased. It is unknown how locomotor and respiratory movements are co-ordinated in LBP. We hypothesised this co-ordination would be altered (either enhanced or compromised) in LBP. **Methods:** Recordings of foot-strike during gait and respiration were made while 10 LBP subjects and 10 healthy controls walked overground at a self-selected speed for 2 minutes. Each inspiratory and expiratory phase was divided into 10 epochs representing 10% of the respiratory phase. The frequency of heel strikes during each epoch was recorded. **Results:** In healthy subjects the frequency of foot strikes was reduced in the first epoch of expiration and increased in the last. In LBP, co-ordination of locomotor and respiratory movements was more tightly constrained. Notably, the frequency of foot-strikes during expiratory epochs 2, 6, and 10 and inspiratory epochs 4 and 8 was increased ($p < 0.001$) compared to controls. These data are consistent with tighter constraint between locomotion and respiration. **Discussion:** Results suggest that the co-ordination between respiration and locomotion may be more tightly constrained in LBP in an attempt to reduce the competition between the postural and respiratory functions of trunk muscles. This has important implications for rehabilitation of back pain patients.

The effect of low back pain on lateral rib cage mobility

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The aim of this study was to identify whether rib cage mobility was significantly restricted in LBP patients with poor transversus abdominis motor control compared to asymptomatic individuals with good transversus abdominis motor control. Subjects included 8 LBP and 11 asymptomatic individuals. Cognitive activation of transversus abdominis was assessed via real-time ultrasound imaging. Rib cage movement was recorded in a sitting position during quiet breathing and with maximal inspiration. The rib cage movement was recorded by means of a fast track magnetometer. Lateral rib cage exertion in the LBP group was significantly less than in the asymptomatic group ($p < 0.05$). Superior rib cage exertion in the LBP group was

less than in the asymptomatic group ($p = 0.08$). Anterior rib cage exertion was similar with the two groups. The results of this study indicate that during maximum inspiration, the LBP subjects with a poor transversus abdominus motor control have significantly less lateral rib cage excursion than asymptomatic individuals.

Effect of bladder fullness on postural control in women with and without incontinence

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The pelvic floor (PF) muscles have been shown to provide stability to the lumbopelvic region and to contract in a feedforward manner to assist with postural control. The aim of this study was to determine the effect of bladder fullness on the postural response of the PF muscles in women with and without incontinence ($n = 30$). Activity of the PF muscles was recorded using a vaginal surface electromyography (EMG) electrode during a postural perturbation in which a 1 kg weight was dropped 30 cm into a bucket held by the subject. This was performed either with the subject in control of the timing of the weight drop (expected), or with the timing of the weight drop unknown (unexpected). The expected and unexpected conditions were performed with the bladder empty, and when the subject reported a sensation of moderate bladder fullness. Women with incontinence demonstrated increased levels of PF EMG compared to continent women for both unexpected ($p = 0.01$) and expected ($p = 0.01$) loading conditions. Similarly, abdominal muscle activity was increased in this group. PF EMG decreased when the bladder was full (unexpected: $p = 0.007$; expected: $p = 0.06$); whereas, abdominal muscle EMG tended to increase. The contrasting effects of increased bladder volume on PF and abdominal muscle activity may present a challenge in maintaining continence. Our data have identified that women with incontinence have increased PF and abdominal muscle activity when the bladder is empty. This finding challenges clinical assumptions related to incontinence, and highlights a possible role of the abdominal muscles.

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Impaired motor performance is bilateral in patients with unilateral chronic lateral epicondylalgia

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Lateral epicondylalgia (LE) is a painful condition, usually on gripping tasks, which is characterised by nociceptive system dysfunction and disordered collagen structure but not inflammation. In addition, there are preliminary data indicating the presence of impaired motor performance. The aim of this cross-sectional study was to extend our knowledge of the motor impairments in LE. Forty participants with a clinical diagnosis of unilateral LE and 40 age and gender matched controls underwent a series of motor control measures: i) wrist posture adopted during a gripping task; ii) pain-free and maximal grip strength; and iii) upper limb reaction times and speed of movement. Participants with unilateral LE adopted wrist postures that were on average 11 degrees (95% CI 7 to 14 degrees) less extended, bilaterally, than controls ($p < 0.001$). This was paralleled by increased upper limb reaction times and reduced speed of movement between groups (mean differences 12%, $p = 0.001$). Pain-free grip strength deficits between sides (mean difference -170N , 95% CI 144 to 195N) were also evident in the LE group. These findings indicate bilateral motor performance deficits in participants with unilateral LE, possibly resulting from impaired motor control.

Accuracy of the clinical assessment in diagnosis of carpal tunnel syndrome

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Carpal Tunnel Syndrome (CTS) is a compression neuropathy of the median nerve in the wrist. Diagnosis is made on the basis of the clinical presentation by supplementing a classic nocturnal history with results of provocative, strength, and sensory tests that assess the median innervated hand. While results of electrodiagnostic testing lend support for the diagnosis, it is not routine practice. Describing the relationship between classic symptoms, physical testing and electrodiagnostic testing would inform clinicians about accuracy of clinical diagnosis in CTS. The aim of this study was to determine the accuracy of three quick and simple clinical tests that are advocated for CTS. Twenty-six patients with i) nocturnal symptoms in the palmar hand and ii) electrodiagnostic confirmation of CTS were included, yielding a sample of 42 symptomatic and 10 asymptomatic hands. Results of responses to pinprick testing, Phalen's test, and a modified carpal compression test were compared bilaterally. Analyses of sensitivity, specificity, and likelihood ratios were determined for each test. Results showed that Phalen's test had the best all-round utility with sensitivity of 0.68, specificity of 0.73, positive likelihood ratio of 2.52, and negative likelihood ratio of 0.44. Pinprick testing had the highest positive likelihood ratio of 3.25. These data demonstrated that the combination of nocturnal waking, symptoms in the palmar hand, and a positive Phalen's test

will detect almost 70% of patients with CTS. When these were associated with sensory deficit to pinprick in the median hand, the presentation almost always conformed with electrodiagnostic confirmation of CTS.

Median nerve excitability during upper limb ischaemia in patients with carpal tunnel syndrome

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Physiotherapists assess mechanosensitivity of neural tissues using tests such as the straight leg raise that slides, and Phalen's test that compresses neural tissues. Mechanisms underlying symptom provocation during these procedures however, are poorly understood. The aim of this study was to investigate these mechanisms by comparing an asymptomatic group and a symptomatic sample with carpal tunnel syndrome (CTS). Patients with i) electrodiagnostic confirmation of CTS, and ii) a positive Phalen's test comprised the symptomatic group. Median nerve excitability was assessed using threshold tracking techniques that monitor the threshold current that just excites a nerve. Responses of median sensory and motor axons to electrical stimuli delivered by a computer-controlled external current source were assessed before, during, and after arm ischaemia had been induced by inflating a cuff around the upper arm to 200 mmHg for 10 minutes. Participants' ratings of limb paraesthesia on a 0–10 scale were recorded over the test period. Results from both groups showed that limb ischaemia retarded the electrogenic, oxygen-dependent Na^+/K^+ pump acting on the axonal membrane resulting in depolarisation, and changes were group dependent. This rapidly reversed following release of pressure and ischaemia. Symptom onset and intensity reflected some phases of Na^+/K^+ pump activity. These data demonstrated that ischaemia of a peripheral nerve induces neural depolarisation, which is associated with symptoms of paraesthesia. Procedures that provoke similar symptoms by compressing or sliding nerve may simply reflect altered cell membrane potential. The rationale of treatment models based on mechanosensitivity should incorporate this physiology.

Chronic whiplash pain – evidence of a minor neuropathy?

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Chronic whiplash is characterised by the presence of sensory hypersensitivity. The aim of this investigation was to further explore this issue using comprehensive quantitative sensory testing (QST). 31 subjects with chronic whiplash (> 3 months, Neck Disability Index (NDI): 49 ± 17) and 31 age and gender matched controls participated. QST including electrical, thermal, and vibration detection thresholds were measured from three hand bilateral sites corresponding to the innervation areas of the median, radial, and ulnar nerves. Electrical, thermal, and pressure

pain thresholds were measured over the cervical spine and upper limb sites. The sympathetic vasoconstrictor response was also performed. Preliminary analysis revealed elevated electrical detection thresholds and vibration detection thresholds in most hand sites ($p = 0.03$). The ratio of electrical pain/detection thresholds was significantly less in the whiplash group compared to controls ($p = 0.05$). Heat detection thresholds were elevated in the whiplash group ($p = 0.01$). Pain threshold tests were significantly lower in the whiplash group for mechanical and cold stimuli but not for heat ($p = 0.01$). Whiplash participants also showed a tendency for impaired sympathetic vasoconstriction. The presence of decreased mechanical and cold pain thresholds confirms previous findings of sensory hypersensitivity in WAD. Elevated detection thresholds for electrical, vibration and thermal stimuli indicate impaired function of both large sensory and small nociceptive fibres. Lowered electrical pain/detection thresholds ratios suggest altered central nervous system processing of A-beta fibre input as contributing to the mechanical hypersensitivity seen in chronic whiplash. These findings are consistent with the presence of a minor neuropathy in chronic whiplash injured participants.

Correlation between physical impairments, pain, disability and patient satisfaction in patients with chronic neck pain

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The aim of this study was to investigate the correlations among pain, physical impairments, disability and patient satisfaction in patients with chronic neck pain. A longitudinal cohort study with 6-month follow-up was carried out in a physiotherapy outpatient department. Subjects with chronic neck pain ($n = 218$) were treated with different physiotherapy modalities, twice a week for 6 weeks. Data were obtained for self-reported disability, verbal numerical pain scale, patient satisfaction and two measures of physical impairments (active range of motion and isometric neck muscle strength) during the initial visit, at 6 weeks, and finally at 6 months. Pearson's product moment correlation coefficient was calculated before and after the intervention at week 6 and month 6. Results demonstrated that the correlations among four sets of measurements varied. Moderate correlation was noted between disability and patient satisfaction ($r = 0.50$ to 0.65), and between disability and pain ($r = 0.55$ to 0.63). A fair relationship was found between pain and patient satisfaction ($r = 0.43$ to 0.48), but only weak relationships were found between physical impairments and all other outcome measures ($r = -0.08$ to 0.36). The correlations tended to increase in the follow-up assessments. No strong correlations were found between disability, patient satisfaction, pain, and physical impairments although the correlations tended to increase in the follow-up assessments. The findings support the suggestion that clinicians should address as many relevant aspects of a presenting clinical entity as possible in the management of chronic neck pain.

Validity of lumbar extension measures in McKenzie's Derangement syndrome

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The McKenzie treatment model advocates extension-based treatments for sub-groups of low back pain (LBP) patients and an improvement in extension range is seen as a positive outcome. The treatment model states that patients fitting the McKenzie derangement classification respond faster than other patients. The validity of this treatment model and of the clinical measures of extension has not yet been established. Fifty patients with LBP being treated with extension procedures were classified as Derangement or Non-derangement, based on a McKenzie assessment. Lumbar extension was measured on Day 1 and Day 5 with six different methods. Patients completed the global perceived effect (GPE) scale on Day 5. Construct validity was tested, by comparing extension improvement and the GPE between the two groups. Responsiveness of the six measures was calculated. All patients gained extension range however the derangement group had higher GPE scores and greater improvement in extension range. The modified Schober method in standing was the most responsive method for measuring lumbar extension. The results of this study support the measurement of lumbar extension for patients treated with extension procedures and provide evidence for the construct validity of one aspect of the McKenzie treatment model. The modified Schober method is the preferred protocol for a clinical setting.

An experimental pain model to investigate the validity of the neurodynamic test for the median nerve

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Despite the high prevalence, there are no universally accepted criteria to diagnose carpal tunnel syndrome (CTS). The neurodynamic test for the median nerve is a novel test in the diagnosis of CTS and challenges the median nerve at the carpal tunnel by combined movements of the wrist, elbow, and shoulder. While the inclusion of joints proximal to the wrist may increase the sensitivity of the test, this may be at the expense of the test's specificity. Therefore, this study investigated whether the neurodynamic test for the median nerve was negative when symptoms in the hand did not originate from median nerve compression. Hypertonic saline was infused into the thenar muscles of the right hand in 20 asymptomatic volunteers to induce hand symptoms. The participants were asked to rate the intensity of the induced pain and size of the painful area in 8 different arm positions, while maintaining the wrist in extension. These positions correspond with different stages of the neurodynamic test for the median nerve. As symptoms had a non-neural origin, we hypothesised that the perception of pain would not alter between arm positions with a variable amount of nerve provocation. A one-way, repeated-measures ANOVA revealed no significant differences in pain perception for the different stages of the test ($p \geq 0.22$). Taking into consideration the limitations of an experimental pain model, the results provide indirect support for the use of the neurodynamic test for the median nerve to differentially diagnose CTS from other local wrist pathologies.

Do patients' expectations of test responses affect outcomes?

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With comprehensive information on clinical tests and medical diagnoses widely available, clinicians are often confronted with patients who have formulated their own diagnosis and have expectations on the outcome of clinical tests. This study investigated whether beliefs about the source of symptoms in combination with specific knowledge of clinical tests influences test results. Experimental calf pain was induced in 31 healthy volunteers by infusion of hypertonic saline. Changes in pain intensity were evaluated during a straight leg raise test (SLR) and during manoeuvres added to the SLR which are thought to further increase (hip internal rotation or adduction) or decrease (hip external rotation or abduction) the load on the nervous system. Based on knowledge gathered from an information sheet, 15 participants who believed that saline induced local muscle pain anticipated no change in calf pain with the tests. Sixteen participants who believed pain was induced by 'nerve irritation' expected the pain intensity to vary according to the amount of nerve provocation. Participants who believed the muscle to be the source of pain experienced no change in pain with the tests whereas the group which believed pain was due to 'nerve irritation' experienced significant changes during the SLR and the variations of the test. Pain increased or decreased according to their expectations. The induced pain was of muscular origin for all participants and therefore should not have changed with the SLR or variations of the SLR. This study suggests that misjudgements by patients on their condition may hinder accurate diagnosis.

Culture and acute low back pain in primary care

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There has been very little research on the effect of cultural influences on acute low back pain (LBP). Data from the Australian Census in 2001 indicated that 30% of the population was born overseas. Primary care practitioners should be aware of differing needs and experiences of patients with acute LBP. **Aim:** To investigate cultural influences on patients with acute low back pain presenting in primary care. **Methods:** Patients with LBP for less than six weeks duration preceded by at least one month without pain, presenting to primary care practitioners (physiotherapists, general practitioners, or chiropractors) were eligible for the study. Baseline data were collected, and follow-up assessments were performed at six weeks, three months, and 12 months. **Results:** Preliminary analysis of 1107 patients indicated that patients born overseas who sought primary care for their LBP were more likely to see a general practitioner than a physiotherapist ($p < 0.05$), less likely to exercise prior to their episode of acute LBP ($p < 0.05$), and more likely to be bothered by feelings of depression at baseline ($p < 0.05$). There was no difference in baseline pain and disability between patients born in Australia or overseas. At six week follow-up patients who

were born overseas were less likely to be recovered ($p < 0.05$). Further data on cultural influences will be presented at the conference. **Discussion:** Preliminary analysis suggests that there are cultural differences in the experience of LBP in Australia.

A randomised clinical trial of spinal manipulative therapy versus exercises for chronic low back pain

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Background: General exercise in a group (GE), individual specific stabilisation exercise (SSE), and spinal manipulative therapy (SMT) are commonly used treatments for chronic low back pain but the relative effectiveness is unknown. **Methods:** To establish the most effective treatment we conducted a single blinded, randomised trial in three physiotherapy hospital outpatient departments. Two hundred and forty subjects with chronic non-specific LBP were randomised to receive either GE (n = 80), SSE (n = 80), or SMT (n = 80). The primary outcomes were Global Perceived Effect and the Patient Specific Functional Scale. Secondary outcomes were Roland Morris Disability Questionnaire and a VAS pain scale. Outcomes were assessed at baseline, 8 weeks, 6 and 12 months. Of the 240 subjects 93% attended the 8-week follow-up, while 88% attended the 6-month follow-up. **Results:** All three groups showed significant improvements from baseline on the primary and secondary outcomes at the 8-week and 6-month follow-ups. SMT and SSE were more effective than GE at the 8-week follow-up for the primary outcomes, with SSE being more effective than GE for the secondary outcomes also. There was no significant difference between the SMT and SSE groups on any outcome at 8-week follow-up. At 6-month follow-up no significant differences were observed between the three groups. **Conclusion:** SSE and SMT are more effective than GE, however as they entail individual treatment they are probably more expensive than GE. The 12 month results will be described in the presentation.

A placebo controlled trial investigating the effectiveness of Mulligan C1/C2 rotation SNAG in cervicogenic headache

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The aim of this study was to determine the effectiveness of the Mulligan C1/C2 rotation SNAG in the management of cervicogenic headache. A double-blind, randomised, placebo-controlled trial was designed using 'Consolidated Standards of Reporting Trials' guidelines. Thirty-two subjects with chronic cervicogenic headache based on International Headache Association classification criteria, with a restriction of at least 10° on the cervical flexion-rotation test, were randomly assigned to a SNAG or placebo mobilisation group. Subjects' range of rotation during the flexion-rotation test was measured before and

immediately after the first trial intervention. A blinded assessor, using a modified cervical range of motion device, carried out measurements. An index of headache severity was calculated, using a previously reported headache questionnaire, before, and after one month of daily intervention in both groups. All subjects used a Mulligan cervical self-SNAG strap, but the placebo did not involve rotation of the spine. Mean rotation before treatment was 24 degrees in the SNAG group and 27 degrees in the placebo group rising after treatment to 39 degrees and 32 degrees respectively. The SNAG group improved their range to a greater extent than the placebo group ($p < 0.001$). Initial headache index scores for both groups were 39/100 and 38/100. After the one-month intervention period, headache index scores in the SNAG group reduced by 16/100, with no change in the placebo group ($p < 0.001$). These results indicate that we can recommend the use of the Mulligan C1/C2 rotation SNAG in the management of cervicogenic headache.

Systematic review of the diagnostic accuracy of 'red flags' for fracture in low back pain patients

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The diagnosis of fracture in patients presenting with acute low back pain (LBP) is an important responsibility of primary care practitioners. A diagnostic systematic review was performed to determine the accuracy of the 'red flags' for detecting fracture in LBP patients. An electronic database search was conducted combining sensitive search strategies for diagnostic tests, LBP, and fracture. Ideal studies would investigate clinical populations of LBP patients in primary care, and report data on the sensitivity and specificity of signs and symptoms in detecting fracture. Studies were assessed using eligibility criteria for inclusion into the review, followed by methodological quality assessment and data extraction. The search strategy identified a total of 5282 articles whose titles were screened for eligibility. Following this the abstracts of 550 relevant articles were classified depending on study type (case report, case series, case-control, or clinical population). The abstracts of 64 articles reporting on a relevant clinical population were assessed for eligibility by two reviewers. Thirteen articles were determined to be eligible for review and data extraction. Only three of these articles were based in primary care settings. The lack of quality studies on fracture in primary care and the low prevalence of this condition make it difficult to draw firm conclusions on the accuracy of the diagnostic tools available. Full results of the review will be presented at the conference.

What is the real prognosis of acute low back pain?

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Most clinical guidelines portray acute low back pain (LBP) as a benign, self-limiting condition. A commonly cited statistic is that 90% of patients recover within six weeks. There are, however, few methodologically

sound prognosis studies so there is some doubt about this statistic. Prognosis of acute LBP was assessed in the first 835 patients of a population-based inception cohort study. Consecutive patients presenting to primary care practitioners (physiotherapists, general practitioners and chiropractors) with acute LBP were recruited. Patients were eligible if they had LBP for longer than 24 hours but less than two weeks, and if the current episode was preceded by a period of at least one month without LBP. Recovery was measured in three ways: the participant was i) pain-free, ii) had no interference with function due to pain, and 3) had returned to usual work status. Follow-up assessments have been completed for 737 participants at six weeks, 663 at three months and 156 at 12 months. More than 98% have completed all scheduled follow-up assessments. After six weeks, 26% of participants reported recovery on all three measures. At three months, 49% of participants reported complete recovery and by 12 months only 64% reported complete recovery. These preliminary results suggest that most LBP guidelines are overly optimistic and that acute LBP may not be as self-limiting and recovery may not be as rapid as previously thought.

Meta-analysis of exercise for chronic low back pain

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Background: Primary care guidelines recommend exercise for patients with chronic non-specific low back pain (LBP). A meta-analysis was conducted to evaluate evidence for the efficacy of exercise interventions on outcomes of pain and disability. **Methods:** Randomised controlled trials were retrieved via a search of electronic databases and citation tracking. Eligible trials investigated exercise on patients with LBP of at least three months duration and included a pain or disability outcome. Outcomes were converted to a 0–100 scale and pooled within three contrasts: exercise versus no treatment; exercise as a supplement to another treatment; exercise versus non-exercise treatment. **Results:** 14 trials of generally low methodological quality, reporting on 1126 subjects were included. Meta-analysis revealed no significant difference between exercise and no treatment (pain: mean -3.2 , 95% CI -11.1 to 4.8 ; disability: mean -9.6 , 95% CI -21.3 to 2.0), no additional benefit gained through the addition of exercise to another treatment (pain: mean -4.9 , 95% CI -10.5 to 0.7 ; disability: mean -1.7 , 95% CI -3.8 to 0.4), and that the effects of exercise were not significantly different from those of other treatments (pain: mean 1.3 , 95% CI -8.5 to 11.1 ; disability: mean -5.0 , 95% CI -17.0 to 6.9). **Conclusions:** A synthesis of available trials suggests that exercise is not effective for chronic LBP. The exercise programs implemented varied widely in type and dose. Three features were associated with successful exercise programs in the included trials: supervision, duration of at least eight weeks, and progression of exercises.

Exercise and/or advice for subacute low back pain?

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Background: The efficacy of advice and/or exercise for patients suffering from subacute low back pain has not been established, despite being recommended in all guidelines for management of LBP. **Methods:** To establish efficacy we conducted a placebo-controlled randomised controlled trial in physiotherapy clinics in Australia and New Zealand. 259 subjects were randomly allocated to exercise and advice (n = 63), sham exercise and advice (n = 63), exercise and sham advice (n = 65), and sham exercise and sham advice (n = 68). The exercise program consisted of 12 sessions of an individualised, progressively increasing program to improve functional activities. The sham exercise consisted of 12 sessions of detuned ultrasound and detuned short-wave. Advice consisted of three sessions of information and instruction, and sham advice consisted of three ‘ventilation’ sessions (conversation without advice). Pain, disability and global perceived effect were measured at 6 weeks, 3 months, and 12 months. **Results:** Follow-up was > 90% at each time point. There was evidence for the efficacy of advice or exercise as single treatments at 6 weeks and 3 months, but not at 12 months. The combination of exercise and advice provided larger treatment effects that were statistically significant at all time points. **Conclusion:** This trial is the first to provide evidence of the efficacy of advice or exercise as single treatments for the treatment of subacute low back pain. The larger and more sustained effect of advice combined with exercise supports the use of both treatments together for patients with subacute low back pain.

Optimising physiotherapy care for acute low back pain – identifying non-responders to treatment

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Recent evidence suggests that positive effects of physiotherapy for acute low back pain patients can be achieved if treatment is delivered early enough. However it is clear that not all patients treated with physiotherapy are likely to report equally positive outcomes from their treatment. The identification of clinical characteristics of those patients who do less well will help refine models of care for acute low back pain. **Aim:** To identify non-responders to early active physiotherapy. **Method:** A secondary analysis was conducted on the data from a recently published randomised controlled trial of early physiotherapy for acute low back pain. All patients were randomised into two groups (immediate physiotherapy or advice and wait list) and completed a series of physical, psychological and pain measures at baseline and again at six weeks. Multivariate statistical analysis was conducted to identify which patient baseline characteristics were associated with unsuccessful outcomes at the six week

follow up. Control group comparisons permitted only those relationships associated with the intervention to be described. **Results:** Data analysis indicated that subgroups of patients who responded poorly to their physiotherapy treatment could be identified by *a priori* knowledge of their pain, mental health, and physical function ($p < 0.05$). **Conclusions:** The results of the current analysis suggest that there are identifiable subgroups of patients who respond less well to physiotherapy treatment. Attention to these patient characteristics needs to be included in models of care for acute low back pain so that effects of therapy for all patients can be optimised.

Prevalence and characteristics of mid-back pain in a general population of men

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Introduction: Epidemiologic studies of low back and neck pain are abundant, but research on mid-back pain is scant. No previous studies reporting the characteristics of mid-back pain in the general population were found. This study reports the one-year prevalence, severity, frequency, and associated disability of mid-back pain in comparison to neck and low back pain. **Methods:** Male twins aged 35 to 70 years (n = 600), from a general population sample, were interviewed with standardised pain questions. Pain characteristics were summarised using descriptive statistics. Logistic regression for correlated data was used to obtain crude odds ratios for low back and neck pain using mid-back pain as an independent variable. **Results:** The one-year prevalence of mid-back pain was 17.0% (95% CI 14.0 to 20.0) compared to 64.0% (95% CI 60.2 to 67.9) for neck and 66.8% (95% CI 63.1 to 70.6) for low back pain. The frequency of mid-back pain was similar to low-back and less than neck pain. The mean severity of the worst pain episode of mid-back, low back, and neck pain was similar (38 to 45/100); however, associated disability was reported somewhat less frequently from mid-back pain (24% vs 30–41%). Odds ratios for neck and low back pain in those with mid-back pain were 2.32 (95% CI 1.42 to 3.78) and 2.87 (95% CI 1.66 to 4.95) higher than in those without mid-back pain, respectively. **Conclusions:** Mid-back pain is associated with a higher likelihood of low back and neck pain. When present, worst episodes were similarly severe as neck and low back pain, but were somewhat less likely to be disabling.

Craniocervical flexor muscle impairment over a spectrum of muscle contraction intensities is a feature of neck pain

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Deficits in craniocervical flexor (CCF) muscle performance are present in painful neck disorders, and rehabilitation of CCF muscle performance has proven effective in reducing the painful symptoms of cervicogenic headache. The aim of this study was to investigate if CCF muscle impairment is present over a spectrum of contraction intensities (maximal, moderate, low) in neck pain sufferers (symptomatic participants) compared to individuals with no history of neck pain (control participants). Isometric

craniocervical flexor (ICCF) muscle strength (isometric maximal voluntary contraction [IMVC]), and endurance at moderate (50% of IMVC), and low (20% of IMVC) contraction intensities was compared in 46 symptomatic participants (Neck Disability Index [NDI]: mean \pm SD 22.8 \pm 5.2) and 47 control participants (NDI: 2.6 \pm 2.6) using an isometric craniocervical flexion dynamometry method. Compared to the control group, the symptomatic group had a significant deficit (15.9%) in their IMVC peak torque recordings, as well as a significantly reduced capacity to sustain ICCF muscle contractions to task failure, at 20% of IMVC (35% deficit), and 50% of IMVC (27% deficit), contraction intensities. Symptomatic participants also demonstrated poorer accuracy in maintaining their IMVC₂₀ contraction at the nominated ICCF muscle torque amplitude ($p = 0.02$), compared to control participants. It would appear that impairment in ICCF muscle performance exists over a spectrum of contraction intensities in neck pain sufferers. These deficits may require specific therapeutic intervention.

Screening for craniovertebral instability: A new look at the evidence

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The use of clinical tests to screen for ligament injury in the upper cervical complex of patients with headache or post-traumatic neck pain remains a controversial issue. Recently, the New Zealand Manipulative Physiotherapists Association published their Pre-screening Requirements for Cervical Spine Management. This protocol includes craniovertebral ligament testing, describing it as a 'priority'. With our Trans-Tasman neighbours adopting this position, and considering mutual recognition of registration, it is timely to consider mandatory testing in clinical practice in Australia. While such moves are motivated by patient safety, we need to decide whether there is sufficient evidence to support the routine use of these clinical tests. Published work describing the anatomy of the craniovertebral region, clinical presentation of ligamentous lesions, and validity and reliability of craniovertebral instability tests, was identified using an unrestricted search of five databases (MEDLINE, CINAHL, EMBASE, AMED, Cochrane library). Research examining screening tests was evaluated using criteria proposed by the Cochrane Collaboration. Descriptions of the ligaments in the anatomical literature are inconsistent or contradictory. There is no agreement on the symptoms and signs of craniovertebral instability. The majority of the instability tests have not been validated in any population and none has been demonstrated to be reliable in a post-traumatic population. This remains an area requiring considerably more applied research. While not advocating the abandonment of these safety tests on an 'as indicated' basis, it would be premature to follow the New Zealand lead and advocate these tests as a screening requirement for patients with cervical spine pain.

Predictors of outcome for subacute low back pain

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Aims and methods: We conducted a placebo-controlled randomised controlled trial (n = 259 participants) to determine effectiveness of exercise and advice for subacute low back pain (i.e. pain of 6 weeks to 3 months duration). A secondary aim was to identify prognostic factors and to predict who would respond best to each treatment. Outcomes included pain measured on a 0–10 numerical scale, disability using a patient-specific functional scale (PSFS), and global perceived effect, measured at the conclusion of 6 weeks of treatment and at 3 and 12 months after entry to the study. Predictors of outcome entered into the stepwise regression model were age, gender, sick leave due to low back pain, initial pain intensity, initial disability, fear-avoidance behaviour (Tampa scale), catastrophising, stress, anxiety, depression, coping strategies, self-reported physical activity level prior to onset of low back pain, and pain self-efficacy. **Results:** At 6 weeks, lower self-efficacy scores predicted greater pain and disability. At 3 months lower exercise level prior to onset of low back pain predicted poorer outcomes on all variables, and at 12 months higher initial scores for catastrophising predicted poorer prognosis on all variables. Good early response to exercise (reduced pain and disability, but not global perceived effect) was predicted by lower disability scores, and good early response to advice was associated with low levels of fear-avoidance behaviours. **Conclusions:** These data suggest exercise is most useful for patients with low levels of disability, and advice is most useful for people who exhibit little fear-avoidance behaviours.

Are sustained natural apophyseal glides an effective treatment for cervicogenic dizziness and pain?

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Cervicogenic dizziness is dizziness associated with neck pain or headache. Although a potentially disabling problem, its management has lacked scientific evidence. This study aimed to determine the efficacy of sustained natural apophyseal glides (SNAGs) in the treatment of cervicogenic dizziness and pain. A single-blind randomised controlled clinical trial was undertaken. Thirty-four participants with cervicogenic dizziness were randomised to receive SNAGs (n = 17) or a placebo of detuned laser (n = 17). Participants received four to six treatments over four weeks. The Dizziness Handicap Inventory (DHI), visual analogue scales for dizziness and cervical pain, and a frequency of dizziness measure were administered by a 'blinded' assistant before treatment, after the final treatment, and at six and 12 week follow-ups. The SNAG group had significantly less dizziness post-treatment ($p = 0.001$), at six weeks ($p < 0.001$), and at 12 weeks ($p < 0.001$) compared to pre-treatment, lower scores on DHI ($p = 0.001$, $p < 0.001$, $p < 0.001$ respectively), decreased frequency of dizziness ($p = 0.03$, $p = 0.03$, $p = 0.03$ respectively) and less pain ($p < 0.001$, $p = 0.001$, $p =$

0.01 respectively). The placebo group had no change post-treatment or at six weeks, although there was a significant change by 12 weeks. It was found the SNAG treatment had a clinically and statistically significant sustained effect in reducing dizziness, cervical pain, and disability caused by cervical spine dysfunction. The results provide evidence for the benefits of a physiotherapy treatment for cervicogenic dizziness.

Spinal manual therapy induces mechanical hypoalgesia in an acute inflammatory animal model

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Spinal Manual Therapy (SMT) is a treatment modality commonly utilised for the management of painful musculoskeletal conditions. The characteristics associated with hypoalgesia following SMT are well described, yet the mechanisms responsible remain speculative. Human experiments are unable to produce direct empirical evidence and as such, an animal model is required for investigation. This study investigated the application of endogenous inflammatory mediators to produce an acute inflammatory model of pain and the effectiveness of SMT in non-anaesthetised rats. In Experiment 1, endogenous metabolites were injected into the right hindpaw of six male wistar rats under light anaesthesia. Mechanical nociceptive thresholds were assessed prior to hindpaw inflammation and at six time points post induction of inflammation. In experiment 2, SMT was performed at L5 vertebra in the mobilisation group for a total of 3 minutes at 5 minutes post inflammation (n = 6). In the control condition, light stroking was used over the lumbar spine for the same time period (n = 6). The first experiment showed significant swelling of the right hindpaw ($p = 0.02$) along with significantly lower mechanical nociceptive thresholds at 10 ($p < 0.01$) and 15 minutes ($p < 0.05$) post induction of inflammation. The second experiment showed that mechanical nociceptive thresholds were significantly increased ($p \leq 0.009$) immediately following a 3 minute application of SMT compared with the control condition. Thus, injection of endogenous metabolites produced significant swelling and decreased mechanical nociceptive thresholds. Three minutes of SMT produced significant mechanical hypoalgesia in an acute inflammatory pain model. This has not been demonstrated previously in non-anesthetised animals.

Muscle responses to the upper limb neurodynamic test (median nerve bias) as a nociceptive stimulus in subjects with arm pain

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This study investigated muscle responses to the upper limb neurodynamic test, median nerve bias (ULNT1) in subjects with current unilateral arm pain (n = 7), subjects with a history of unilateral arm pain (n = 12) and asymptomatic subjects (n = 41). Electromyography (EMG) of scalenes and upper trapezius bilaterally and biceps and wrist flexors ipsilaterally was recorded during a baseline control

condition, an upper limb passive movement (PM), and the ULNT1 performed on both sides. Subjects indicated the onset of pain via a computerised handswitch. Two-second epochs of EMG were taken at the start of the test (Beg), a 90 degrees elbow flexion position (Elb90), the end of range of elbow extension (EOR) and at the end of an EOR ten second hold (Endhold) for the PM and ULNT1, and at pain onset in the ULNT1. For each epoch the root mean square error (RMS) was determined and normalised to mean baseline RMS. There was a main effect for group ($p = 0.02$) for the scalenes, with the symptomatic group having greater scalene activity. There were no other significant differences between the groups and the sides for muscle activity. For all groups and muscles there was a significant increase in activity between Elb90 and the onset of pain, EOR and Endhold in the ULNT ($p < 0.001$). No increase in muscle activity occurred across the elbow extension phase of the PM condition. The ULNT produces an increase in muscle activity that may be a nociceptively mediated protective response to a perceived threat to nerve health.

Can end-of-treatment outcomes be predicted by reassessment of signs or symptoms within one or two treatments?

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Precise treatment application relies on feedback that is directly related to the desired outcomes. Little is known, however, about relationships between reassessments used in clinical practice and outcomes at end-of-treatment. Within-session changes when pain intensity (Δ PAIN), pain location (Centralisation) and of range of movement (Δ ROM) are reassessed predict some between-session changes and reassessing centralisation predicts end-of-treatment outcomes for some interventions. We investigated the ability of reassessments within the first two treatment sessions to predict end-of-treatment outcomes for patients (n = 28) receiving manual therapy treatment (average 3.4 treatments). Measures for reassessment (Δ PAIN, Centralisation, global perception of change and Δ ROM) were recorded before and after each treatment. End-of-treatment outcomes were assessed by changes in pain intensity, Patient Specific Functional Scale, Neck Disability Index, and global perception of change. The ability of reassessments within the first two treatment sessions to predict end-of-treatment outcomes were analysed using Pearson's correlation coefficients and regression trees. Subjects were also categorised as improved or not improved and groups compared using ANOVA and classification trees. Each of the reassessments at some time in the first two treatment sessions predicted at least one of the end-of-treatment outcomes. No reassessment or combination of reassessments in the first two treatments was able to predict treatment outcomes as determined by more than one outcome measure. Interestingly there was little relationship between the four end-of-treatment outcome measures. The small sample size may account for the small number of significant results. The advantages of using the statistical tools of classification and regression trees will be discussed.