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Spinal disc replacement

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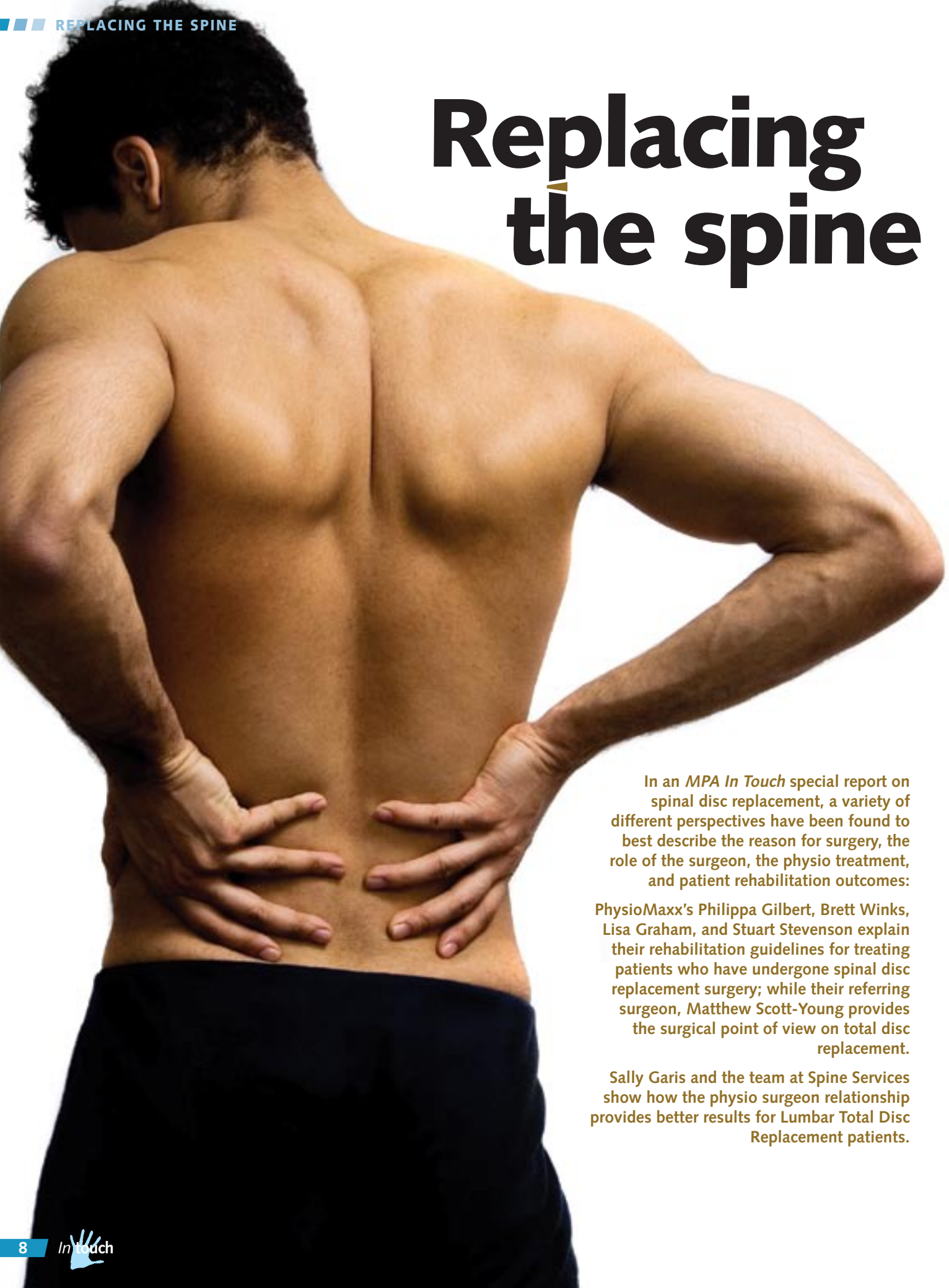
Replacing the spine



In an *MPA In Touch* special report on spinal disc replacement, a variety of different perspectives have been found to best describe the reason for surgery, the role of the surgeon, the physio treatment, and patient rehabilitation outcomes:

PhysioMaxx's Philippa Gilbert, Brett Winks, Lisa Graham, and Stuart Stevenson explain their rehabilitation guidelines for treating patients who have undergone spinal disc replacement surgery; while their referring surgeon, Matthew Scott-Young provides the surgical point of view on total disc replacement.

Sally Garis and the team at Spine Services show how the physio surgeon relationship provides better results for Lumbar Total Disc Replacement patients.

Total disc replacement

Dr Matthew Scott-Young

The surgical goal of a spinal procedure is to reconstruct the spine to reduce pain, improve function, restore biomechanical activity, and return the patient to their social, recreational, and employment activities.

Lumbar fusion remains the surgical procedure of choice for many patients with chronic, persistent low back pain of disc origin who are unresponsive to nonsurgical management. Three main problems arise following fusion procedures:

- Bone graft donor morbidity;
- Pseudarthrosis;
- Adjacent motion segment disease.

Up to 20 per cent of patients may require further surgical intervention within the first five years following a successful spinal fusion.

A growing number of surgeons have looked beyond fusion for the treatment of chronic, persistent low back pain of disc origin and have embraced total disc replacement. Total disc replacement eliminates bone graft morbidity, eliminates pseudarthrosis, and reduces the adjacent motion segment degeneration rate. The benefits are considerable in that it relieves pain by removing the painful degenerative disc, it restores the height and stability of the affected motion segment, and it restores the spinal kinematics to the normal range.

It is widely accepted that a spectrum of pathology exists within the adult disc, ranging from internal disc disruption to frank degenerative disc disease. This degenerative process is often asymptomatic, but it can result in symptoms known as discogenic back pain. The symptoms arise from, first, the instability that results from a disc that has lost its integrity. The second component of the pain is associated with the fact that the outer layers of the annulus and endplates are innervated by the sinuvertebral nerves and sympathetic nerves. These nerves can be stimulated by chemical and mechanical stimuli that result from injury and degeneration and, as a result, pain is produced.

The general, broad indication for total disc replacement is anyone from 20 to 60 years of age, who has back and / or leg pain of proven discogenic origin, and who has exhausted conservative management over a period of one year.

In performing a lumbar total disc replacement procedure, an anterior approach is taken. The rectus muscle is split in order to gain access to the retroperitoneum. This allows one to approach discs quite easily from L3-4 to L5-S1. Once the disc has been exposed in its entirety, the annulus is then incised and the outer layer reflected. The macroscopic portion of the disc is then removed. This is then followed by removal of the cartilaginous endplate.

The next step is to restore the disc height and lordosis. I use the Charité Artificial Disc, which is a modular and unconstrained prosthesis and, therefore, allows for a variety of anatomical and pathological situations. The disc prosthesis is then inserted, the endplates seated, and the core inserted.

The position of the prosthesis is verified by using an image intensifier. It is extremely important to get the prosthesis in an optimal position, as it then gives the disc replacement a chance to work. Studies have confirmed that suboptimal position results in suboptimal outcomes.

A number of studies have investigated the use of total disc arthroplasty. The majority of these studies have been retrospective and often included both single and multiple level cases from multiple surgeons and centres with less than a two year follow-up. However, over the last few years, an abundance of prospective data has been published. This includes the landmark Class I Prospective Randomised Trial, which led to the Charité prosthesis obtaining Food & Drug Administration (FDA) approval in the United States. The results of this study have provided the impetus for four randomised prospective clinical trials in the United States, using the Maverick, Flexicore, and ProDisc prostheses.

I have performed over 370 lumbar disc replacement procedures, with up to 10 year follow-up. The results with single or multiple level procedures show no statistically significant difference. If the patient selection process is satisfactory and the surgical technique is sound, then 90-95 per cent of people can expect a greater than 50 per cent relief of their pain. In general, the average reduction in back and leg pain is approximately 80 per cent and the average improvement in functional capacity is about 80 per cent. The return to work rates approaches 90 per cent.

One of the key issues that can result in an unsatisfactory outcome relates to what occurs during the postoperative phase. I regard inadequate rehabilitation as one of the primary reasons for poor clinical results following disc replacement. It is essential to develop a rehabilitation programme that revolves around the principles of restoring normal lumbar mobility, strengthening core stability, and working on flexibility. It is important to understand that these individuals have had long histories of chronic persistent back pain and present with poor physical conditioning prior to treatment. They also have a psychological outlook that needs additional help.

I have used Physiomaxx to preoperatively assess my total disc replacement candidates. The Physiomaxx team institute educational and mechanical therapy programmes appropriate for each individual in the preoperative phase with a view to improving postoperative recovery.

Postoperatively, a graduated rehabilitation programme is instituted that works on maintaining posture, improving flexibility, and working on core stability. The programme is upgraded in a commonsense fashion to increase aerobic fitness. This eventually instils in the patient an enthusiasm for maintaining their physical fitness for life.

A well thought out, thorough, and caring preoperative and postoperative rehabilitation management strategy is the key to returning disc replacement candidates to their normal activities of daily living. The goal is to improve their general fitness and wellbeing, as well as improve their psychological outlook.

Since instituting this rehabilitation programme in my practice, I have seen a statistically significant improvement in patient outcome scores between the three month and six month postoperative reviews.

With the advent of lumbar disc arthroplasty, a new surgical strategy for the treatment of chronic persistent low back pain has come to fruition. There is clear evidence that total disc replacement has a role in the treatment of discogenic low back pain. It promises to relieve pain, reduce disability, and improve return to work rates.

Dr Scott-Young is an orthopaedic surgeon based on the Gold Coast, Queensland, who specialises in spine surgery.

Spinal disc replacement surgery

PhysioMaxx Rehabilitation Guidelines

By Philippa Gilbert, Brett Winks, Lisa Graham, Stuart Stevenson

Physiotherapy for spinal disc replacement patients is a new and relatively un-researched field of orthopaedic and musculoskeletal physiotherapy. Whilst physiotherapists have long worked with spinal surgery patients, gone are the days of prolonged bed rest, log rolling, and no movement of the spine. Spinal disc replacement surgery offers patients near-normal physiological range of movement of the motion segment, better pain relief, and a much improved long-term prognosis.

At PhysioMaxx, we have been working with Dr Matthew Scott-Young and his spinal surgery patients for six years. As well as single level disc replacement, we have worked with multiple level disc replacements, and hybrid procedures including anterior and / or posterior fusions combined with single or double level replacement, for both the cervical and lumbar spines. During this time, our management of these patients has evolved and been refined through clinical reasoning and experience, to the protocol we now follow; the most recent data has shown a 100 per cent return to work in these patients.

As an artificial disc is designed to move, and therefore preserve motion at the operated segment(s), a rehabilitation program needs to address the following:

- Restore normal lumbar mobility and address poor movement patterns which may have occurred as the result of pain;
- Restore correct posture;
- Improve poor motor control of the core stability musculature which may have developed with a history of lower back pain;
- Strengthen the upper and lower limbs which may have weakened due to preoperative inactivity;
- Improve general fitness;
- Reduce neural tissue dysfunction and help overcome post-operative distraction pains;
- Ensure good scar mobility;
- Ensure adjacent segments are moving correctly and facet joint symptoms are addressed;
- Maintain a positive outlook, as patients' preoperative symptoms will often have had a significant impact on their home and work lifestyle.

Preoperative physiotherapy

We have found a pre-operative assessment to be valuable if the patient is able to attend, and their pain allows. This allows us to obtain a detailed history from the patient, and get some early objective measures including pain, ROM, neural tension and neurological testing. We use the McKenzie Method of Mechanical Assessment and Diagnosis for our assessment as it allows us to determine if a patient's symptoms have a directional preference.

Preoperative visits to our clinic also allow us to teach our patients how to activate their core muscles under real-time ultrasound, and often we are able to commence them on a clinical Pilates program depending on the severity of their symptoms, or provide treatment if indicated.

Hospital management

Average hospital stay is five to seven days. During such times, and throughout the rehabilitation process, constant positive reassurance is vital.

Early mobilisation is important, progressing from a frame to no walking aids for lumbar spine surgery. A soft collar is usually supplied following cervical surgery. Chest physiotherapy and circulation exercises are commenced from day one, and TED stockings are provided.

Neural glides are commenced, as are gentle spinal ROM exercises, upper and/or lower limb strengthening, and postural education. We tend to avoid excessive and repetitive extension, lateral flexion, rotation, and prone lying initially due to the anterior operative approach.

Patients are discharged once they are mobilised on stairs and their bowels have opened. Following discharge, patients are reviewed in the clinic one to two weeks later.

Postoperative physiotherapy

Patients are re-assessed on their first postoperative visit, as they can present with a number of symptoms. Reinforcement and encouragement is an extremely important part of the patient's early stage management. The physiotherapist needs to be motivational, encouraging, and supportive in order to gain the confidence of the patient and achieve compliance throughout the rehabilitation program. Pain and functional limitations may be experienced for three to 18 months and patients must be made aware of this.

- The position, quality, and intensity of pain is checked. Pain is most commonly neurogenic, muscular tightness, facet joint, or distraction pain.
- The patient's walking program is checked and advice is given when necessary i.e., increase distance or time.
- Reinforce no excessive or repetitive extension, rotation or lateral flexion until approximately six weeks.
- Check wound healing.
- Massage may be performed on the abdominal or neck region to relieve tightness and prevent scar adhesion. The patient is encouraged to perform daily self-massage of the abdominal area if required following lumbar spine surgery.
- Check pain medication.
- Review posture in sitting, standing, lying as well as transfers and gait.
- Specific muscle control exercises are commenced – deep neck flexor retraining (with or without pressure biofeedback) in the cervical spine, and transversus abdominis and multifidus retraining (pressure biofeedback or ultrasound) for the lumbar spine.
- Muscle tightness is commonly found in the gluteal and deep external rotator muscles, iliopsoas, quadratus lumborum and the erector spinae of lumbar disc replacements patients. Similarly, for cervical disc replacement, upper trapezius, scalenes, levator scapulae and sternocleidomastoid are often affected. Stretches, massage, and trigger point therapy can be beneficial for these.
- Thoracic spine stiffness and pain may be coexisting, and mobilisations or stretches may be utilised.
- Flexion mobility is encouraged for both the lumbar and cervical spine, as well as limited rotation in the cervical spine.
- Clinical Pilates is generally started at this

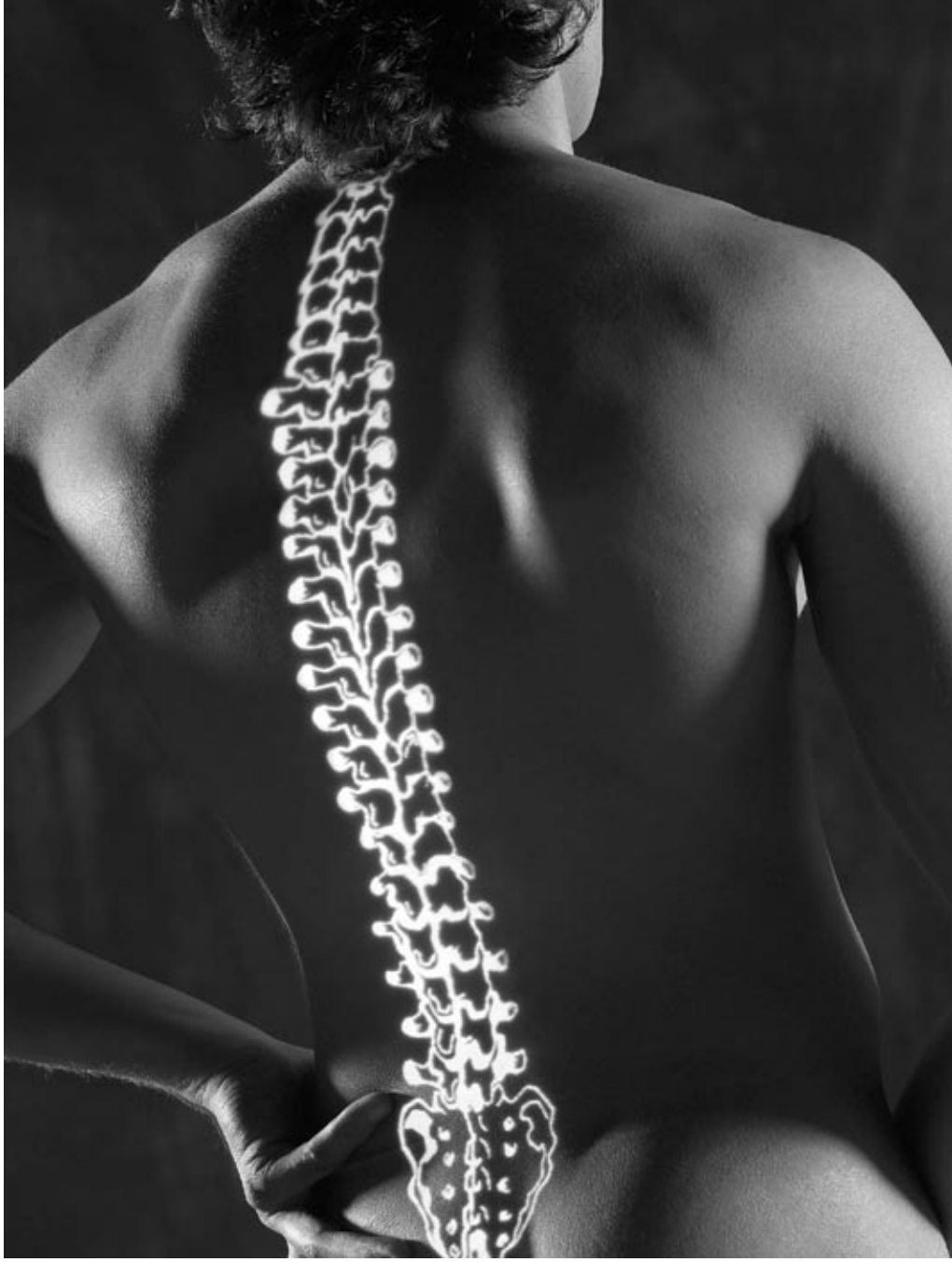
time. We have found this form of exercise improves stability and movement awareness; this is important as patients can lose proprioception in the operated region and need to re-learn segmental as well as global control of their movement.

Around the six weeks post-operative mark, we start looking to gain full range of movement in all directions. This effectively means increasing all levels of activity and progressing as appropriate.

We have found extension of the lumbar region to be particularly important at this time, as quite often it is a painful movement prior to surgery, and can be quite restricted, even uncomfortable once initiated. We address movement restrictions that persist with a combination of biased clinical Pilates exercises, joint mobilisations and home exercises such as stretches or specific muscle strengthening.

Work hardening or return-to-sport programs are initiated depending on the patient, or a supervised gym program is commenced if desired. Jogging and running are usually started between six and twelve weeks post-op, as well as swimming, assuming there is sufficient wound healing. Home programs often involve Pilates floor work, and Theraband or fitball exercises.

After performing a literature search, it was revealed that there is a significant paucity in research regarding rehabilitation following disc replacement surgery. Considering this, *PhysioMaxx* intends to contribute to the development of future studies. Following surgery, appropriate rehabilitation is of the utmost importance. By combining a detailed knowledge of the surgical procedure with patient specific physiotherapy, we have been able to provide a new and exciting alternative for those patients suffering from spinal pain for which conservative management has been unsuccessful.



Eight weeks post op following a L4-L5 TDR (total disc replacement) and L5-S1 ALIF (anterior lumbar interbody fusion).

PhysioMaxx

PhysioMaxx is a Queensland physiotherapy practice.

Lumbar Total Disc Replacement

Working with surgeons augments results, writes Sally Garis

The Dilemma

Chronic Low Back Pain (CLBP) or pain in the lumbosacral region lasting more than three months, afflicts nearly 200 000 Australians every year. The direct cost of the condition is $1.2 billion, whilst the damage to the national economy is $9.8 billion per annum. It is also a major cause of social and financial concern to the individual as it is associated with disability, impaired quality of life, and loss of productivity. About two per cent of these sufferers undergo spinal stabilisation surgery as a final option to relieve pain and disability, and to improve function and quality of life.

Surgical solutions

Whilst spinal fusion has stood the test of time, complications associated with instrumentation such as pseudo-arthrosis, bone-graft site morbidity, slow post-operative recovery and adjacent level degeneration are concerns. Lumbar Total Disc Replacement (LTDR) may offer a promising alternative to fusion. A mechanically articulating structure, can re-establish spinal biomechanics by restoring inter-vertebral disc height and providing in-direct decompression of lumbar facet and neural structures whilst restoring and maintaining mobility of the motion segment. Potential advantages of LTDR are prevention of adjacent segment non-physiologic loading and subsequent degeneration, maintenance of range of motion (ROM) and avoidance of complications associated with segmental fusion.

Indications and contra-indications

Indication for LTDR is a patient with severe chronic back pain for greater than six months that has failed at least six months of supervised non-operative treatment, including anti-inflammatory medication, analgesia, physiotherapy, and spinal injections, who continues to be significantly disabled. The patient must be skeletally mature without any co-existing osteoporosis (i.e., 18 to 60 years old), facet arthrosis, or canal stenosis.

Contra-indications include but are not limited to spinal deformities or instability, facet hypertrophy, morbid obesity (BMI more than 30), sequestrated herniations or a significant prolapse that causes cauda equina syndrome.

Procedure

Total lumbar disc prostheses are implanted using an anterior approach whilst maintaining extraperitoneal access. A transverse 'bikini' approach is frequently used to access the L5-S1 disc space. All other lumbar levels are accessed using either a midline or paramidline vertical incision. Complications that may arise with LTDR include damage to the superficial rectus nerves due to prolonged distraction, prosthetic loosening, sinking of the prosthesis (subsidence) and neural or segmental stretching due to segmental distraction causing bilateral leg pain. These complications are of critical relevance to the physiotherapist when designing a rehabilitation programme.

Physiotherapy and rehabilitation of patients following LTDR

Physiotherapist involvement in all stages of the care of patients undergoing LTDR has proven to be valuable in our setting. In the pre-operative phase the patient is educated in regards to how to attain and maintain a neutral lumbar spine posture during the functional tasks of log rolling, sitting, standing, and bending. Low-grade activation of Transverse Abdominus (TA), Deep Lumbar Multifidus (DLM) and glutei is commenced prior to surgery.

In the post-operative phase, care must be taken to ensure adequate fixation of the prostheses at the bone-prostheses interface. Thus, for the first six to eight weeks, patients wear a lumbo-sacral elastic brace to assist wound healing and limit unwanted movement. Hyperextension, rotary movements, and lifting over five kilograms is restricted to avoid prosthetic loosening and / or subsidence. If the patient demonstrates a painfully restricted straight leg raise bilaterally, this could be due to segmental distraction causing a dural stretch, in these cases neural stretches should only be introduced in a graded manner at six to eight weeks.

Post-operative rehabilitation takes place over three broad phases. Phase One (zero to

six weeks) commences day one after surgery and should involve a graded walking program, resumption of static TA, DLM and gluteal activation and gentle hip ROM stretches in supine with a neutral spine. Phase Two (six to 12 weeks) aims at gradually attempting to normalise functional movement and change the active loading characteristics of the effected motion segment. Pre-operative concepts regarding attainment of the neutral spine in static postures of sitting and standing are progressed to include dynamic movements such as rising and lowering into a chair, bending and lifting. Neural and muscular flexibility of the lumbo-pelvic-hip complex is used to complement motor relearning by altering the passive load to the affected lumbar segment. Goals of Phase Three (>12 weeks) are to progress dynamic control of the lumbar lordosis in complex, trunk upright positions with and without external load. The patient is then challenged to control their lumbar lordosis in work and sport specific positions. Training may take place at the gym where load and number or speed of repetitions can be graded appropriately.

Fig.1

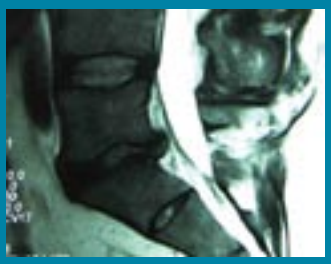


Fig.2

Fig.3

Fig.4

Outcomes

Recent two and three year follow-up studies have demonstrated clinically significant reductions in pain and disability, and improved general health status occurring as early as 10 days post-TDR in patients with CLBP. This trend in outcomes continues to improve up to the two year mark. When compared with spinal fusion TDR has demonstrated a greater overall satisfaction and faster reduction in pain and disability scores in the first nine months after surgery. Prospective analysis of data from a cohort of 49 Spine Service patients who underwent Prodisc LTDR (Figure One to Four) has shown encouraging results. Visual analogue scale (VAS) for back pain significantly decreased. Pre-operatively the mean VAS was nine on a scale of zero to 10. At 24 months following TDR the mean VAS was two out of 10 ($P<0.05$) (Figure Five). There was a five-fold improvement in physical functioning ($P<0.05$) and a four-fold improvement in social function ($P<0.05$) at 24 months. Oswestry Disability Index showed a decrease in disability over the 24 months ($P<0.05$) (Figure Six). Six months post surgery was a turning point for the better for most patients. Forty of the patients had stopped all pain medication at 12 months. Three complications were encountered, none of which affected the patient outcome.

Conclusion

LTDR presents an exciting, and encouraging surgical prospect for carefully selected CLBP patients. Preoperative and postoperative management of LTDR patients is team based, with challenging rehabilitative implications for the musculoskeletal physiotherapist.

Fig.5

Fig.6

This article is available for re-print with references upon request. For more information visit Spine Service website at: www.spine-service.org or email s.garis@spine-service.org

Lumbar Total Disc Replacement – Working with Surgeons Augments Results
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Chronic low back pain research update

Chris Maher is an Associate Professor at the University of Sydney, and here he looks at what's going on in research into chronic low back pain?

Chronic low back pain is a common and costly problem in Australia. Recent research has improved our understanding of this health problem and highlighted how physiotherapy can reduce the burden of this disease.

Understanding the problem of chronic low back pain.

It could be argued that the best way to manage chronic low back pain is to manage acute low back pain well. Current evidence on the clinical course of acute low back pain would suggest that there is definitely scope for improvement in its management.

Previously, it was believed that most cases of acute low back pain recovered quickly with or without treatment. Acute low back pain was portrayed as benign and self-limiting. This belief seemed to be the basis for the minimal intervention approach that was promoted in many clinical practice guidelines for the management of acute low back pain.

However, recent research at the University of Sydney has shown that this optimistic view is not true. The typical clinical course of acute low back pain is for rapid improvement in the first month followed by ongoing mild pain and disability for some months with a high risk of recurrence in the next year. The reality is that for many people acute low back pain is not a self-limiting condition.

This research is in agreement with Australian population-based surveys that have revealed that about one in 10 Australians have chronic low back pain. In fact chronic low back pain is one of the most common long-term health conditions in Australia. It is only surpassed in frequency by long and short sightedness. Chronic low back pain is a concern for those who suffer from it, and those who fund its care, with about half of those with long term low back pain seeking care in the previous six months.

Given the new knowledge about clinical course, there has been some reconsideration of the minimal treatment approach for acute low back pain. Advice and paracetamol may not be sufficient for all patients with acute low back pain. This basic care may need to be supplemented for example with physiotherapy treatments such as spinal manipulative therapy, McKenzie therapy, and directional preference exercise – which have been shown to be effective for acute low back pain.

Preventing recurrence is also now a key issue for researchers and clinicians. Two quite different approaches to exercise – one developed at the University of Queensland, and the other in Scandinavia – have been shown to markedly reduce the risk of recurrence. Ultrasound-guided multifidus exercises delivered during the acute phase and active back school delivered after the initial symptoms have resolved, have both been shown to markedly reduce the risk of recurrence. In the Queensland study, the risk of recurrence in the exercise group was a third of that in the control group who did not exercise. In the Scandinavian study, the risk of recurrence halved and the protective effect of exercise remained at three year follow-up.

Choosing the right treatment for a patient with chronic LBP

There are many ways to choose treatment for a patient and one is to choose treatments that have been shown to be effective in clinical trials. Until recently, identifying effective treatments for chronic low back pain was difficult because there were no evidence-based treatment guidelines.

The recently published European guidelines have summarised the evidence for treatment and provide an authoritative source of information to assist clinicians to select the right treatment for a patient. It is important to recognise that many contemporary treatments, both conservative and surgical, are not believed to be effective for chronic low back pain. This situation may explain why a large number of people fail to respond to the care provided. It is likely that many did not receive known effective treatment and this may partially explain why two million Australians have chronic low back pain.

Finding reliable evidence on the effects of treatments is now much easier with the European Guideline and resources such as PubMed and the Physiotherapy Evidence Database (or PEDro). PEDro has an advantage over all other databases as the trials archived on PEDro are rated for methodological quality to help users distinguish between trials which are likely to be valid and interpretable and those which are not.

Later this year a consumer version of PEDro will be launched to help health consumers access the latest evidence on the effectiveness of physiotherapy treatments. Hopefully, greater access to, and understanding of, the evidence, will help solve the problem of chronic low back pain in Australia.

A new and popular theory is that it is possible to identify the sub-group of patients who will respond to a given intervention based upon results of the clinical examination. Clinical prediction rules to identify patients who would respond to spinal manipulation or respond to stabilisation exercise have been developed and tested. The advantage of using a prediction rule can be substantial with one study showing that patients who fitted the prediction rule had double the chance of a successful outcome than those who do not. In parallel, there has been research investigating the influence of patient preferences on the outcome of treatment. As might be expected, patient outcomes are better when they receive the treatment they prefer and also when they are more satisfied with the process of care.

While the issue has not been directly tested in research, it seems likely that patient outcomes will be best when the process of care is informed by evidence from clinical trials, the patient's preferences, and by attempting to match the treatment to the patient. Hopefully we will see this sort of research undertaken in the near future.

Understanding what patients value

While it may seem surprising, there is actually very little information on the views and opinions of people who have chronic low back pain. Important questions, such as, what do patients expect from physiotherapy treatment; how do patients' determine that they have recovered; and, patient's views and preferences on various tests and treatments, have largely been ignored in research. Clearly, more work in this area is needed.

We do know from a UK study of patients receiving physiotherapy for low back pain that patient satisfaction with care is not simply determined by the outcome of care. The personal and professional manner of the physiotherapist, their ability to provide information and involve the patient in decision making, as well as the structure of service provision, are all key dimensions of patient satisfaction with physiotherapy management of low back pain.

We also know that the process of care advocated in guidelines may conflict with the views and expectations of patients. This can be illustrated with reference to routine radiography of the spine which is now discouraged in most clinical practice guidelines and by reference to the diagnosis – non-specific low back pain.

While guidelines discourage the use of radiographs, patients view the situation differently. In a trial evaluating routine radiography versus guideline-based radiography, the patients in the routine radiography group were more satisfied with care. Interestingly, this occurred even though pain, function, and overall health status were the same in both patient groups. Another study surveyed patients with low back pain referred for plain radiographs and found that most (72 per cent) thought that radiography was very important. The proportion was higher for men than women (85 per cent versus 65 per cent) and for those with worsening symptoms than improving or static symptoms (86 per cent versus 65 per cent). Those who were inappropriately referred for radiographs (based upon guideline recommendations) were more likely to view radiographs as important, than those who were appropriately referred. Deciding whether or not to request a radiograph is therefore a lot more complex than is often portrayed in practice guidelines.

Qualitative research has also highlighted potential problems with the use of the term non-specific low back pain. Patients with low back pain expect an accurate diagnosis and are often dissatisfied when they do not receive one or receive different diagnoses from different providers. Patients also have negative feelings towards providers who do not provide a diagnosis, with patients regarding the diagnosis as important in terms of legitimising their experience of pain. The challenge here for clinicians is that many patients will not regard the label non-specific low back pain as a diagnosis.

Conclusion

As is often the case, the research that has been recently completed in this field has served to identify additional questions that need to be answered. However, the research has provided a greater understanding of the problem and identified some ways physiotherapists can contribute to the solution of this health problem.