Rolling exercises designed to train the deep spinal muscles

Wayne Haynes

Abstract A number of therapeutic interventions imitate motor learning skills performed during infant development. The following exercise training program adapts infant rolling to theoretically provide a specific functional rehabilitation outcome. The exercise program intends to restore a normal segmental spinal muscle contraction strategy which is an essential component of locomotor functional stability.

Introduction

The author proposes a new exercise training program designed to specifically activate the deep spinal muscles (The Multifidus Reactivation Technique). In this program distinct rolling movements are enacted. The adult* rolling exercises are intended to imitate infant mature and automatic rolling. The author also theoretically suggests that imitating infant rolling movements can initiate the reflex/reactive muscular contraction of the deep spinal muscles.

The exercise program has four levels of progressions beginning with a pass/fail test for deep lumbar extensor muscle activity. After mastering level one the client is then progressed to the next more demanding challenge. In the final progression a client is trained to perform a specific, highly skilled and complex global movement pattern whilst holding a bilateral co-contraction of the deep spinal muscles. Increasing the functional requirement of a challenge makes the skill a progressive one. This allows quantification of present skill level and future skill improvements.

Multifidus Reactivation Technique is designed to be part of a progressive multi-care manual therapy program. It is intended to act in co-operation with other therapeutic tools to reduce pain and restore the required or desired functional status of a client. This movement activity can also be part of a general health and fitness itinerary.

The Multifidus Reactivation Technique is an experimental exercise technique and the proposals as to its therapeutic value are untested except from the author’s own clinical experience. It is hoped that future research may provide insights into the validity of the model proposed.

*Adult refers to an individual whose movement patterns are
Rolling exercises for deep spinal muscles

The above-mentioned educators acknowledge in their teachings the relevance of infant movement skills, such as rolling, as part of the underlying motor control training program from which more sophisticated motor skills evolve in the mature individual (Kolar 2002, Feldenkrais 1984).

The author proposes to distinguish infant rolling skills as an integral motor training program to acquire skillful segmental spinal stiffness. This property is an essential element of whole body locomotor functional stability.

Locomotor functional stability – what is it?

The consequences arising from poor control of adult human movements has been the focus of many researchers and clinicians in the study of low back pain disorders (Hodges & Richardson 1999a, Luoto et al. 1999, O'Sullivan et al. 1997). Poor 'motor control' has been implicated as a primary key link in the chain of influences leading to many musculo-skeletal dysfunction and pain syndromes (Hodges 2001). Rolling is part of the repertoire of human movements and can also exhibit poor motor control patterns in some individuals.

A primary goal of skillful motor control during any movement pattern is locomotor functional stability. This involves the application of a whole body movement strategy for the safe, efficient and stable orientation of an individual whilst pursuing an intention-driven ongoing movement task.

The movement performance relies on dynamical factors such as:

1. Task to which the movement is applied.
2. Environment in which the movement is performed.
3. Level of skill the individual has obtained through maturity and practice.
4. Specifics of an individuals structure.
5. The intention and motivation to move.

Numerous progressive steps are taken during infant development to acquire locomotor functional stability. The author suggests these movement patterns to be essential to the development of sophisticated motor control strategies that are active during most movement challenges.

Some infants do not progress through a normal sequence of motor milestones yet still develop mature adult motor responses! These individuals may however express a non-preferred and less skillful strategy at much lower thresholds of environment and task-specific challenges.

It is possible that poorly skilled rolling may imply deficits in global motor control abilities and reflect poor functional stability under very low levels of task and environment challenges. Careful assessment of a rolling activity may provide valuable information on the health of the motor control system.

The equation of dynamical factors active during the production of a movement and the quality of that movement defines the concept 'motor control'. A motor control pattern is unique to a specific task, environment, experiences and skill. For this reason no two movement patterns can be exactly the same.

It is the belief of the author that at an individual specific threshold, the dynamical influences on the motor control system will activate a preferred, skillful and correct motor control strategy. However, beyond this dynamical threshold, a non-preferred, incorrect and less skillful motor control strategy may be
triggered. The non-preferred strategy is similar and may be part of the repertoire of human movement skills found during infant motor development (Haynes 2003).

It is further proposed that over time and with repeated activation of a non-preferred strategy, the individual-specific threshold level may be lowered so that an alternative movement pattern becomes habit. The non-preferred pattern may involve less skillful movement expressions associated with higher metabolic cost, increased joint load and altered muscle co-ordination. For example, a non-preferred strategy can be performed in particular subjects when executing a single leg standing activity (Luoto et al. 1998, Mouchnino et al. 1998).

Luoto et al. (1998) found a non-preferred motor control strategy involving a loss of normal dynamic pelvic alignment and an ‘incorrect’ weight shift solution associated an altered firing pattern of the gluteus medius muscle on the support leg side. Luoto et al. (1998) also linked this strategy to a possible predictive factor for future incidence of low back pain.

Mouchnino et al. (1998) found that the skillful study participants conducted single leg standing using a predominantly sophisticated feedforward strategy and controlled pelvic and vertebral alignment using individual articular segmental control tactic. The poorly skilled group utilized a predominantly feedback mechanism to hold a single leg standing posture. Mouchnino et al. (1998) argued the non-preferred strategy involved greater muscle co-activations and a ‘locking down’ (en-bloc) of consecutive vertebral articulations.

The author suggests that over time a non-preferred motor control pattern may lead to an environment in which an individual specific expression of pain may occur.

The alternate motor control pattern may have its origins in the feedback-based motor learning programs designed to train the skillful acquisition of upright locomotion (en-bloc) (Assaiante and Amblard 1995, Haynes 2003). En-bloc is a term to describe the locking down of consecutive articular motion segments to reduce the degrees of freedom available to perform a particular movement task. The term has arisen from the pioneering work of Bernstein (Whiting 1984) and then developed in the context of infant motor control by French researchers including Assaiante and others (Assaiante and Amblard 1995).

**Neurologic, Energetic, Biomechanic and Cognitive Sub-systems and functional stability**

There are numerous and dynamically related human structural sub-systems – the Neurological, Energetic, Biomechanic and Cognitive sub-systems – contributing to the production of human locomotion and functional stability (see Box 1).

When acting together in a coordinated fashion the Neurologic, Energetic, Biomechanic and Cognitive sub-systems structural potentials are converted into the kinetic abilities to efficiently and functionally stabilize the human body as well as control and enact global movement patterns.

Functional stability is a complex interaction of multiple influences that evolve and mature during a lifetime, particularly the first seven years of life. The aim of motor learning is to create task-specific, efficient and skillful motor control strategies that have meaning and consequence. Rolling is an excellent example of a transitional motor learning task that is part of the evolving and maturing motor control strategy contributing to functional stability.

Infant motor development patterns may provide simple clues to better understand and treat low back pain and dysfunction. Infant motor development provides a sequential and progressive learning environment involving the maturation and experiential development of Neurologic, Energetic, Biomechanic and Cognitive Sub-systems. This

<table>
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<th>Box 1 Neurologic, Energetic, Biomechanic and Cognitive Sub-systems dynamical influence on functional stability (Whiting 1984)</th>
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<tr>
<td>1. <strong>Neurological</strong> The functionally related neuronal synapses interconnect to provide the neural highway to transmit sensory impulses, central commands and motor effector impulses. Interconnections that create sub-conscious control reflexes, reactions and responses are also also formed in this sub-system (Winters &amp; Crago 2000).</td>
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<td>2. <strong>Energetic</strong> The energetic or muscular component of a motor control strategy provides the systems force Component. Four basic muscular influences exist (Commerford &amp; Moltram 2001a,b):</td>
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<tr>
<td>3. <strong>Biomechanical</strong> The inherent individual and age-dependent physical characteristics that form the interlinked mechanical human structure.</td>
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<td>4. <strong>Cognitive</strong> Human higher neural centers involved in the intention of movement formation. It involves all aspects of free will including motivational and personal intentions that stimulate an individual to move in a specific way.</td>
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interaction may provide a key link between infant motor development and adult low back pain and movement dysfunction. Infant and adult rolling skills fit into this category.

**Neurologic, Energetic, Biomechanic and Cognitive Sub-systems and infant movement patterns**

Through a life span non-preferred motor control responses similar to those exhibited during transitional infant development may present in adulthood (described in part one of this series – Haynes 2003). These non-preferred patterns are most often present in musculo-skeletal pain patients. Imitating infant motor learning patterns, whilst adapting them for the adult Neurologic, Energetic, Biomechanic and Cognitive Sub-systems, may provide us with practical and effective treatment skills. The movement patterns are intended to affect a global chain of movement activities to retrain motor control programs in adults suffering pain and movement dysfunctions. Multifidus Reactivation Technique has been designed with this philosophy in mind.

It is proposed by the author that the rolling skill to be described imitates mature and automatic infant rolling. The rolling activity is adapted for the adult Neurologic, Energetic, Biomechanic and Cognitive Sub-systems. The technique theoretically trains the deep segmental muscles of the lumbar spine in a progressive manner until a sophisticated global movement pattern is mastered. It is believed that one function of the deep segmental spinal muscles is to provide segmental spinal stability (Mosleley et al. 2002). This property is described in detail in the following section.

**Segmental spinal stability**

There are two primary muscular recruitment strategies involved in whole body stability and orientation and are integral parts of the energetic aspect of Neurologic, Energetic, Biomechanic and Cognitive Sub-systems. These cooperative strategies are enacted in response to goal-directed movement tasks. The two primary strategies are:

1. Spinal segmental muscular stiffness.

The author believes that segmental and multi-segmental strategies differ in their evolutionary development, pattern of appearance during ontogenic development, task requirements and muscle strategy utilized (a summary of the differences appears in Table 1). (Kent 1992, Kardong 2002).

**Lumbar segmental stability**

Lumbar segmental spinal stability is provided by anticipatory or reflexive co-activation of the ‘web of muscles’ surrounding the lumbar motion segments (Hodges & Richardson 1999a,b, McGill & Cholewicki 2001, Moseley et al. 2002). The muscles believed to primarily contribute to lumbar segmental ‘stiffness’ when contracting bilaterally are multifidus and transversus abdominis. Other muscles implicated in segmental spinal stability are the pelvic floor muscles and the diaphragm (Hodges & Gandevia 2000, Sapford & Hodges 2001).

In healthy no low back pain subjects, the deep fibers of

<table>
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<th>Table 1 Summary of muscular stabilizing strategies</th>
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<tr>
<td><strong>Segmental stability</strong></td>
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<tr>
<td>• Local, deep, segmentally located muscles</td>
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<td>• Anticipatory and reactive activation of response involving segmental web of muscles</td>
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<td>• Contraction strategy not dependent on the direction of the perturbation or the task</td>
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<td>• Function to stiffen the consecutive motion segments</td>
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<td>• Hypothesized that infant rolling progressions develop spinal segmental stability</td>
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<td>• Hypothesized that human rolling has its evolutionary origins as an orientation mechanism developed to prevent rolling in fish.</td>
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<td>The mechanism involves orientation of the head primarily using the vestibular mechanism and involves reactions with various fins, particularly the dorsal and ventral fins, controlled and influenced by musculature analogous to the lumbar segmental muscles in mammals (Kent 1992, Kardong 2002). The metemeric nature of fish hypaxial and epaxial musculature functionally related to the dorsal and ventral fin rays is lost in mammals except in the lumbar and cervical segmental musculature implying a continuation of functional relevance (Kent 1992, Kardong 2002).</td>
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<td><strong>Multisegmental stability</strong></td>
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<td>• More superficially located muscles with multiple bony attachments often spanning many articulations</td>
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<td>• Anticipatory and reactive activation of muscular slings (synergies of functionally linked muscles)</td>
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<tr>
<td>• Contraction strategy depends on direction of perturbations, environment and task</td>
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<td>• Designed to maintain body balance, equilibrium and control of body weight shifts</td>
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<tr>
<td>• Infant movement strategies such as creeping, crawling, lunge, squat, etc. progressively develop and train multi-segmental stability strategies</td>
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<td>• Hypothesized that this skill has a relatively modern evolutionary design essential for mammals to control body weight shifts whilst holding various body segments elevated within the field of gravity</td>
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multifidus have recently been shown to have an anticipatory ‘non-direction-specific pattern of activity’ (Moseley et al. 2002). The deep fibers hold a biphasic tonic level of contraction irrelevant of the forces acting on a specific motion segment. The transversus abdominis also acts in a similar way (Hodges & Richardson 1996). More simply, the deep spinal muscles encasing a joint, contract in the same manner no matter if you are pushed in the back without warning or if you are pushed in the chest with warning.

It appears the deep fibers of multifidus together with transversus abdominis contract in a bilateral synergy to control a lumbar motion segments’ intersegmental position. The shear and axial rotation forces acting on individual vertebral joints is resisted by this strategy (Hodges 2001, Moseley et al. 2002).

A summary of the functional properties of multifidus and transversus abdominis in healthy and low back pain LBP sufferers is found in Box 2.

**The feedback and feedforward activation mechanism**

The contraction strategy of both multifidus and transversus abdominis in healthy subjects can be activated by either feedback or feedforward mechanisms. It appears that the contraction strategy of multifidus and transversus abdominis in majority of low back pain subjects is activated only by the feedback mechanism (Hodges 2001).

**Feedback mechanism**

The feedback mechanism provides a reactive muscular contraction strategy to prevent excessive joint motion occurring from an expected or unexpected perturbation. It is believed to be used as a training program to develop the more sophisticated anticipatory muscular response strategy.

The feedback mechanism is thought to work in the following manner: (Indahl, et al. 1997, Winters & Crago 2000).

1. The sensory receptors generally throughout the body and particularly locally in the lumbar spine (interspinalis and intertransversi muscles spindles, lumbar facet joints and capsule) neurally respond to particular stimulus.

2. The mechanical stimulus is transformed into a nerve impulse and transmitted to the spinal cord.

3. A long loop reflex involving modulation by higher centers (CNS and cerebellum) activates a muscular contraction strategy involving multifidus and transverse abdominis to create control over the individual motion segments.

**Feedforward mechanism**

The feedforward strategy trains the more advanced feedforward anticipatory muscular recruitment activity. Practicing specific tasks, particularly in infant development, is essential in developing the sophisticated feedforward responses (Crutchfield & Barnes 1993).

Anticipation of an alteration of a motion segments normal alignment is an essential component of the mechanisms that prevent musculoskeletal injury (Winters & Crago 2000).

The evolutionary advanced neuromuscular feedforward mechanism uses an experientially developed abstract perception of the task, environment and the bodies relationship with all factors involved in the task (known as the body schema) to predict alterations to the bodies center of mass in relationship to its base of support (Grasso et al. 1998). The resulting pre-programmed anticipatory muscular response reduces the reactive forces that would have been placed on the body if the feedback strategy was in sole use.

Feedforward mechanism uses experiences from feedback training.
to make assumptions about all aspects of a movement task. The assumptions are made at higher neural centers and allow predictions for the future requirements of a movement task, to be made. This simplifies the complex requirements needed in motor control.

Both the feedforward and feedback programs involving segmental muscular contraction strategies provide protection from injury to segmental vertebral articulations during a wide variety of tasks. The muscular contraction patterns have evolved to reduce the amount uncontrolled movement at individual vertebral segments and is associated with the neuro-muscular neutral zone.

**A theory of the ontogenic development of spinal segmental stability**

The following description of the ontogenic development of segmental spinal stability is a theoretical proposition formulated by the author. It has yet to be tested by scientific scrutiny. Note: For a full description of the ontogenic rolling development see Gilfoyle et al. (1990), McGraw (1945) and Crutchfield and Barnes (1993).

The author proposes that lumbar segmental spinal stability develops before multisegmental global stability and mobility. This is achieved through infant movement patterns involving rolling (axial rotation). Infant rolling may be a more complex and crucial pattern of skills acquisition than previously thought. It is proposed by the author to be an essential activity in the training of sophisticated recruitment of segmental spinal muscles in the lumbar spine (and probably the cervical spine). As implied previously, the author believes the skill of axial mobility, i.e. head rotation and torso rolling, dynamically influence segmental differentiation and stability in the infant. The skill develops cephalo-caudal and is controlled by multiple interdependant mechanisms (Neurologic, Energetic, Biomechanic and Cognitive Sub-systems) and also includes the maturation of central mechanisms (moulded by experiences and skill) influencing and 'modernizing' primitive and transitional reflexes.

Infant rolling first begins at about 4 months of age and is achieved through the infant head and arm movements. It is a spontaneous non-intentional act. Torso rolling relies on momentum developed by these structures. The infant ‘log roll’ is not associated with lumbar spine or hip muscular involvement in the task.

**Multifidus Reactivation Technique and mature/automatic rolling**

The Multifidus Reactivation Technique has as its theoretical basis, the mature and automatic
rolling skills exhibited by infants from about 6 to 10 months of age.

Mature rolling is a transitional strategy progressing the infant towards the preferred ‘automatic rolling’ skill.

Automatic rolling incorporates a complex multiskilled action allowing successful goal completion that is broadly reproducible and sophisticated. The infant can initiate rolling from movements of the head, neck, upper limb or lower limb and can roll whilst performing other unrelated tasks, i.e. holding a toy (Gilfoyle et al. 1990).

The refinement of the movement pattern through trial and error produces a smooth sequence of muscle activation’s eventually making movement a ‘gliding’ event. The gliding movement implies a high level of sophistication in the movement act. The author assumes skillful gliding development coincides with the activation of anticipatory postural adjustments. Gliding movements are a desirable outcome for both infants learning to roll and adults using the Multifidus Reactivation Technique.

Rolling possibly provides the kinesthetic awareness of segmental motion characteristics for both infant movements and adults using the Multifidus Reactivation Technique. With this sensory feedback perceptual control over the coupled forces acting upon the motion segment via reflex coordinated muscular activation is proposed to take place.

In a semi-supine position the child can initiate an automatic rolling movement through a hip flexion strategy then control the decent by a spinal extensor strategy. In this way, the first spinal stabilization event resisting the forces of gravity has developed. It is this pattern of movement control that the Multifidus Reactivation Technique hopes to adapt to the adult, for explicit therapeutic purposes.

The Multifidus Reactivation Technique hypothetically imitates the mature and automatic rolling skills of the infant. This program adapts the rolling movements of the infant to suit the adult structure to theoretically gain motor control benefits (see Box 4).

Current techniques designed to train segmental stability

Three exercise rehabilitation programs presently exist to train and restore segmental lumbar muscular contraction strategies. A brief outline of these techniques will follow:

(a) Wobble board rocker board training

Standing and balancing on labile surface devices will activate, by chance, multifidus and transversus abdominis (Bullock-Saxton 2001, Commerford & Moltram 2001a,b).

The high loading component and the high risk of alternative muscular stabilizing strategies during exercise should prohibit this program from choice as a specific segmental stabilizing training technique.

(b) Core stability training

Floor exercises or floor exercises using labile surfaces (swissball or unstable platforms) have been shown to activate multifidus and transverses abdominus stabilizing strategies (Liebenson 1996, Commerford & Moltram 2001a,b). However, the muscular recruitment strategies activated are part of a multisegmental stabilizing and orientation strategy not regarded by the author as ‘segmental specific’.

(c) Lumbar spinal segmental training

Box 4 Proposed outcomes from infant rolling

The Multifidus Reactivation technique may provide movement outcomes that imitate some of the proposed functional developmental achievements from infant rolling. It is hypothesized that mature and automatic rolling by the infant probably initiates:

- Control of the neuro-muscular neutral zone and activation of motor strategies for stable and controlled movement from the neutral zone.
- Prepares baby for upright automatic locomotion and posture by establishing the basic reflexes required for such tasks.
- Initiates the reflex of co-contracture of deep lumbar spinal segmental muscles and transversus abdominis.
- Automatic rolling develops the ability to control spinal coupled motions occurring during axial rotation. The ability to activate and control axial rotation is an essential element during efficient upright gait.
- The formation of abstract temporal and spatial characteristics of the pelvis and the lumbar spine in relation to other body parts and with the external environment. The lumbo-pelvic region provides essential mapping details for ongoing locomotion tasks in bipedal gait activities.
- The establishment of sophisticated feedforward strategy of Anticipatory Postural Adjustment’s involving multifidus and transversus abdominis.
- Sophisticated motor synergies for skilful completion of desired or required movement task.
- Improved cognitive and socialization skills.
- Increased muscle mass associated with increased strength, endurance and motor control.
- Develop subconscious control over segmental spinal relationships creating functional ‘segmental differentiation’
- Hold and move segmental spinal relationships utilising sensory feedback mechanisms.
- Do so in a low loaded environment.
- Cognitively initiate and control a goal directed task using a visually guided predictive mechanism.
- Develop skills to resist axial rotation and shear forces.

It is apparent that many the hypothetical motor training outcomes proposed are goals of spinal segmental rehabilitation training. The author anticipates the Multifidus Reactivation technique provides therapeutic outcomes associated with many of these functional goals.
Developed by Jull, Richardson, Hides and Hodges and described in great detail in the authoritative text ‘Therapeutic Exercise for Spinal Segmental Stabilization in Low Back Pain’ (Richardson et al. 1999). The above-mentioned scientists have developed a biofeedback-based co-contraction re-enforcement exercise training program. This technique utilizes conscious control over multifidus and transversus abdominis contraction training routines. This technique is the present gold standard in segmental muscular rehabilitation.

The use of this training skill is thought to lead to increased cross sectional area in multifidus from training and has been implicated in the prevention of re-occurrences (Hides et al. 2001).

The technique described by Richardson et al. (1999) relies on higher centers to initiate, train and modulate segmental stiffness. Training is conducted in a low loaded environment but uses a non-functional task requirement. Conclusive evidence has yet to be provided that segmental functional reactions in activities of daily living are actually restored through this technique. Restoration of normal physiologic reflexes and reactions has been advanced as a primary goal in low back rehabilitation (Indahl 1995, 1997).

**Protocol For Multifidus Reactivation Technique (MRT)**

**Background**

The Multifidus Reactivation Technique is an exercise training skill that provides an adaptation of infant rolling activities for adult therapeutic requirements. The goal of Multifidus Reactivation Technique is to retrain and restore local and global motor control over the neuromuscular neutral zone by imitating infant-like rolling skills.

The program allows a pass/fail assessment of the muscular activity of the deep lumbar spine extensors. A fail assessment leads a client to the protocol for the unresponsive patient. Clients who successfully activate the deep extensors continue with the initial training phase.

After time and training the client can be further progressed to the exploration phase. The final progression involves a whole body global pattern of activities and is known as functional restoration. This last progression is practised daily.

**Test for multifidus activity**

This test also acts as the initial reactivation exercise.

1. Patient is semi-supine; the body is lying in a fully elongated neutral position, perpendicular to the support surface. The top leg is lying behind and next to the bottom leg, about 5–30 cm apart, in a scissors position. The leg in contact with the ground lies in alignment with the position of the body.

Semi-supine position provides a low loaded environment reflective of the start-up position for infant co-contraction strategies to be developed when initiating automatic rolling activities (Fig. 1).

2. The lateral aspect of the inferior foot, ankle, leg, pelvis and thorax are in contact with the support surface.

3. The head is supported in a neutral position (Fig. 1).

4. The inferiorly placed arm is fully extended, externally rotated, with fingers extended and lies at approximately 110 degrees to the body line (Fig. 1).

5. The inferiorly placed arm is in contact with the support surface as is the lateral aspect of the scapula, the axilla, triceps, olecranon, lateral forearm, pisiform, fifth metacarpal and phalanx (Fig. 1).

6. Practitioner has fingers over multifidus at L5 level on both the left and right sides fingers over L4-5 paraspinal muscles. Multifidus is at its thickest here and is most easily felt and monitored at this point. Either the patient or practitioner can use this bilateral tactile sensation to monitor the reflex contraction of multifidus. It is a simple biofeedback tool as well as a method of increasing local kinesthetic awareness (Fig. 2).

7. Patient is asked to breathe in and out normally. During the end of expiration the patient is asked to gently and slowly pull in their belly button – practitioner should check for normal activation of transversus abdominis and avoid over activity of

![Fig. 1 Start up position for initial training phase for multifidus reactivation technique.](image-url)
external obliques and rectus abdominus. The ‘suck in’ procedure, if conducted appropriately, will activate the transversus abdominis and internal obliques.

To palpate transversus abdominis contracture, place fingers just medial and inferior to the anterior inferior iliac spine. Normal contracture creates a feel of tightness under the fingers. Over activity of internal obliques creates a bulging under the fingers. Over active external obliques appears as a swelling over the lateral lower ribs and an increased lateral abdominal (oblique) line. Over active rectus abdominus appears as abdominal protuberance (Fig. 3).

8. The practitioner asks a client to slowly press the lower ankle into the table/floor – a ‘bulging’ or ‘swelling’ should be felt on the inferior placed multifidus. This strategy probably also occurs in the infant where increased lower leg pressure against the resisting forces of the support surface activates improved kinesthetic awareness, increased momentum and improves control of the rolling act (Fig. 4).

The instruction involving the ankle pressing into the support surface is believed by the author to imitate a ‘push away’ response in the adult similar to the skill of serratus anterior facilitation in upper quarter rehabilitation. As with the upper quarter technique it is a pattern found in ontogenic development, i.e. the push-away response when an infant lifts its bodyweight with its hands by extending the elbows. The same skill is seen in the upright sitting posture of infants that is believed to activate axial co-contraction (Gilfoyle et al. 1990).

9. After experiencing the inferior placed multifidus bulge, the client is asked to slowly and gently lift the superior placed ankle off table or floor by about 1–2 finger widths (between 1–2 cm) Lift heel slowly and gently (Fig. 5).

Practitioner feels for swelling, bulging or even twitching under his/her fingers on the superior placed multifidus (Fig. 5). If there is early ‘bulging’ or ‘swelling’ this is quantified as a pass test. If no activation occurs or only slight
twitching is present, then this is recognized as a fail. Pass/fail assessment is made on the feel of bilateral contraction of multifidus. If the movement is conducted quickly or with a greater amount of force than necessary, the mobiliser muscles may be initiated to contract creating an alternative pathologic pattern of activity.

Lifting only 2cm from the support surface is required; any higher movement may activate mobilizer muscle involvement.

The author proposes that a sudden initiation of pressure against the palpating hands indicates that multifidus is firing. Without this strategy of activation the exercise cannot be continued.

10. Both sides need to be tested. There may be one side more difficult to facilitate than the other. Initially training the active side only may be required, then eventually attempting the alternate side once a competent strategy is established.

11. If successful activation is felt, then the client is instructed to feel for the response themselves by digitally palpating the multifidus at the level of L4–L5 (Fig. 6).

The client is instructed to follow key facilitation aimed at promoting multifidus activation.

**Conclusion**

It has been shown in many studies, the importance of bilateral multifidus and transversus abdominis co-contaction to provide lumbar segmental spinal stability (Moseley et al. 2002, Richardson et al. 1999). The activation of the co-contraction strategy provides a stiffening of the vertebral motion segment.

Studies indicate neuro-physiologic and biomechanic as well as intrinsic muscular changes occur when onset of segmental instability occurs (Hodges & Richardson 1998, O’Sullivan et al. 1997; Hides et al. 1994).

Richardson et al. (1999) provide an excellent exercise rehabilitation technique to restore normal contraction speed, strengthen, endurance and size of multifidus. However, several drawbacks involving this technique include its nonfunctional reactivation approach lacking a reflexive contraction strategy and the difficult practitioner–client implementation protocol.

The Multifidus Reactivation Technique described is proposed to reflexly re-activate a bilateral multifidus contraction. It may also help form an abstract perceptual schema for the activation of anticipatory muscular stiffness strategies in the lumbo-pelvic region.

Multifidus Reactivation Technique theoretically adapts infant rolling skills to the adult Neurologic, Energetic, Biomechanic and Cognitive Sub-systems for explicit therapeutic purposes. It is a skill easily implemented in a modern neuro-muscular rehabilitation setting and its progressive nature provides quantifiable levels of skill acquisition.

The Multifidus Reactivation Technique provides a progressive exercise program focusing on functional rehabilitation of the deep spinal muscles. This allows client progress to be monitored and documented.

The training is conducted in a very low loaded environment so that training can begin at nearly any stage of client functional impairment.

The progressive prescription begins with the reactivation phase.
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