THE COMPLETE GUIDE TO

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POSTNATAL FITNESS

2nd edition

'An indispensable, authoritative and comprehensive manual'

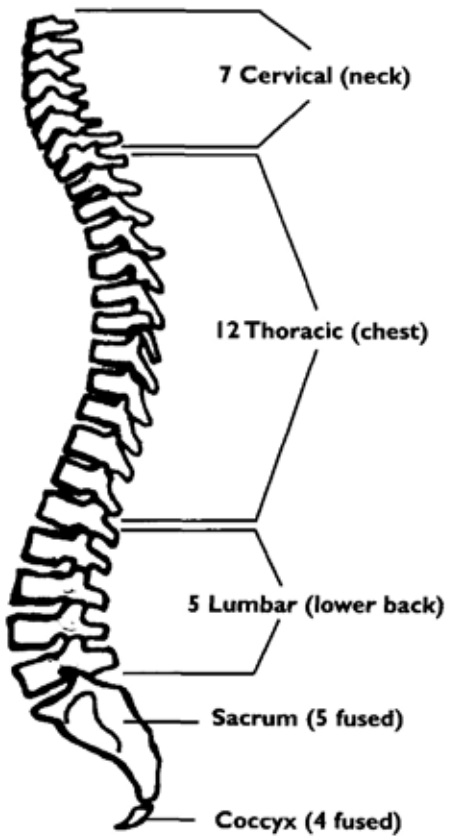
The Guild of Postnatal Exercise Teachers

STRUCTURE AND ALIGNMENT

The Spine

Structure of the spine

Fig. 1.1 **Structure of the spine**



The vertebral column is made up of 33 bones: 24 separate vertebrae, five vertebrae fused together to form the sacrum, and another four vertebrae fused together to form the coccyx. The spine has enormous strength, but since it is made up of small sections it is also very flexible and this allows a large range of movement. The vertebrae are separated by intervertebral discs of fibrocartilage that cushion the vertebrae against jarring and help to keep the spine upright. The curves of the spine are vital for shock absorption; without them the base of the brain would receive the full impact when jumping. The spine is dependent on ligaments as well as muscles for its stability.

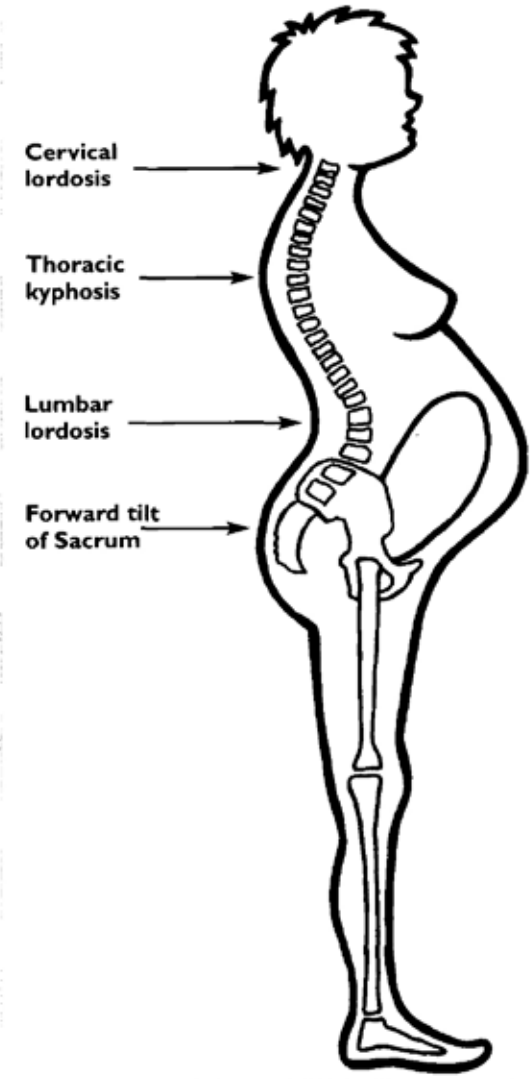
Effects of pregnancy on the spine

The stability of the spine is seriously at risk during pregnancy for the following reasons.

- Increased elasticity of the ligaments.
- Forward pull of the abdomen as the uterus grows out of the pelvis into the abdominal cavity.
- Increased load, causing the sacrum to tilt downwards and forwards.
- Over-stretched abdominal muscles which are no longer able to support the spine.
- Increased size and weight of the breasts.

Common changes in spinal alignment result in increased lumbar lordosis, thoracic kyphosis and cervical lordosis as a consequence of the latter.

Fig. 1.2 **Effects of pregnancy on the spine**



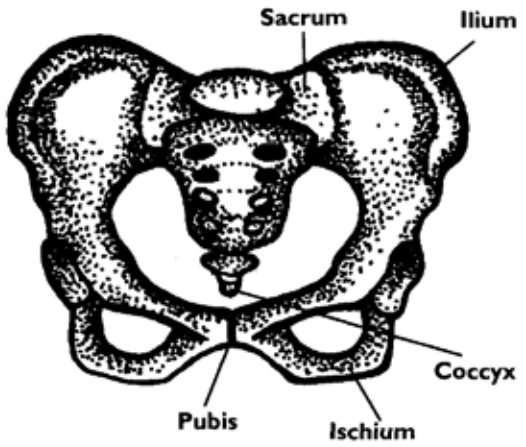
The pelvis

The bones of the pelvis

The pelvis is made up of four bones: two hip bones, the sacrum and the coccyx. Each hip bone is made up of three fused bones, the ilium, ischium and pubis. At the junction of these three bones is the deep socket of the acetabulum.

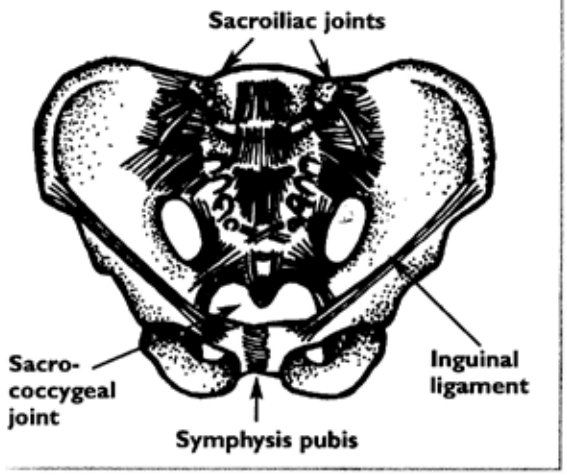
- The **ilium** is the large wing-shaped part of the pelvis providing a broad surface area for muscle attachment. The upper border, the iliac crest, can be felt when the hands are placed on the hips. The bony points at each end of the iliac crest can be felt at the front, as the anterior superior iliac spines (ASIS and at the back, as the posterior superior iliac spines (PSIS) of the pelvis. These are useful landmarks when checking correct postural alignment.
- The **ischium** is the thick, lower part of the pelvis leading down to the ischial tuberosities.
- The **pubis** is at the front of the pelvis where the two pubic bones join to form the symphysis pubis at the top and the pubic arch underneath.
- The **sacrum** is a triangular-shaped bone made up of five fused vertebrae. It is joined to the ilium by the sacroiliac joints, which are positioned on either side of the sacrum.

Fig. 1.3 **Bones of the pelvis**



- The **coccyx** consists of four fused vertebrae joined to the sacrum at the sacrococcygeal joint. This joint has a small amount of movement that may allow the coccyx to be pushed backwards during delivery.

Fig. 1.4 Joints of pelvis showing ligaments



The joints of the pelvis

The pelvis is formed by two halves that join at the front at the symphysis pubis and at the back at the sacroiliac joints.

- Symphysis pubis is situated at the front of the pelvis, where the two pubic bones meet. Separated by a pad of cartilage resembling a vertebral disc, the joint is approximately 4mm wide prior to pregnancy and held together by ligaments.
- Sacroiliac joints are two joints formed by the unity of the ilium with the sacrum at each side. The strongest joints in the body, they are held together by ligaments. They allow very limited backwards and forwards movement during flexion and extension of the trunk (sacral nodding) as well as a sideways tilt which occurs when walking.

Effects of pregnancy on the pelvis

The three joints of the pelvis – one symphysis pubis and two sacroiliac – are vulnerable during pregnancy. Hormonal changes allow the ligaments supporting these three joints to become more elastic, increasing their range of movement and consequently reducing joint stability. The width of the symphysis pubis may increase to 9 mm, causing severe discomfort around the pubis and groin, and in severe cases the joint may separate. In some cases however, pain around the pubis may not always be reflective of the degree of movement at the joint. This condition is known as symphysis pubis dysfunction (*see* section on symphysis pubis pain on page 49). Increased laxity in the sacroiliac joints may cause pain in one or both sides of the pelvis. Alternatively, pain could be the result of the two joint surfaces becoming stuck together, causing stiffness and reduced mobility.

The pelvis is dependent upon the correct alignment of the symphysis pubis and sacroiliac joints and pain experienced in one area is generally consistent with misalignment of the whole structure.

Relaxin

What is relaxin?

Research has identified relaxin as a hormone produced in both pregnant and non-pregnant women (Bani 1997). Produced primarily by the corpus luteum, it reaches its highest levels during pregnancy when it is also produced by the placenta and the decidua. Increased levels of relaxin are evident in the body from as early as the second week of pregnancy and continue until delivery. Monthly production resumes with the recommencement of the menstrual cycle. Relaxin levels are higher in second and

subsequent pregnancies and in women carrying more than one baby.

What effects do increased levels of relaxin have on the body during pregnancy?

The most significant change occurs in the collagen fibres of connective tissue, found in cartilage, tendons, ligaments, muscles, skin etc. Increased levels of relaxin appear to affect the remodelling structure of collagen fibres by increasing the water content which in turn increases their size and elasticity. This directly affects joint stability as the ligaments are unable to provide the same degree of support as before.

Increased elasticity of the ligaments allows the pelvic joints a greater range of movement and, together with the forward tilt of the sacrum, increases the size of the pelvic outlet by 28 per cent. This is vital to accommodate the growing baby and allow an easier birth.

Which joints are most at risk?

All joints will be affected to some degree and although there is concern for the ankles, knees and elbows during exercise, it is the pelvic joints that are mostly at risk. The symphysis pubis and sacroiliac joints are cartilaginous, or slightly moveable, joints that rely solely on ligaments for their stability. The resulting increased range of movement created by relaxin, together with the progressive pressure exerted by the growing baby, makes these joints particularly vulnerable.

Are muscles affected by relaxin?

Connective tissue surrounds bundles of muscle fibres that merge together and extend beyond the muscle to form the tough, inelastic tendon. The relaxing effects of the collagenous fibres afford a greater range of movement for the muscle and its attachments. It is essential for the abdominal muscles to stretch to allow the uterus to grow out of the abdomen, and for the pelvic floor muscles to stretch to deliver the baby. However, this adaptation severely reduces the support previously given by these muscles and has major implications on muscle function and support (*see* Chapters 2 and 3).

What happens to relaxin after delivery?

Production of relaxin ceases on delivery of the placenta. However, the changes that have occurred to the collagen fibres will continue until new tissue has been reformed in the absence of relaxin. This may be a period of up to five months postnatally. Reduced joint stability should still be strongly considered when exercising postnatally as the body continues to be vulnerable during this time.

Do the joints regain their stability?

If the joints have been overextended during pregnancy, the ligaments may not provide sufficient stabilisation. However, if appropriate care has been taken the ligaments should return to their pre-pregnancy inelastic state once the lingering effects of relaxin have left the body. The absence of pressure from the baby greatly reduces the risks to the pelvis, but whilst the increased range of movement is still evident the pelvis should be treated with much respect and caution.

Breastfeeding women may find increased joint laxity continues until feeding stops although there is no evidence to support this at present.

Posture

Posture is strongly influenced by habit and controlled by our own kinesthetic awareness, good or bad, of what 'feels right'. Correct postural alignment is governed by the strength and suppleness of specific muscles. Good posture is not a static position; correct alignment is constantly challenged as the body moves.

Why is correct posture so important?

When the body is misaligned it has to work harder to maintain an upright stance. Muscles that are not designed to support the body are recruited to take up the slack and they become too tight. In addition to placing extra strain on the joints and their support structures, tight muscles will decrease range of movement and pull the body out of alignment. If that's not enough, overly lax muscles tire easily in the attempt to counterbalance the forces and the body begins to sag. Such changes in muscular balance increase the degree of compression on the vertebrae and intervertebral discs and decrease blood flow.

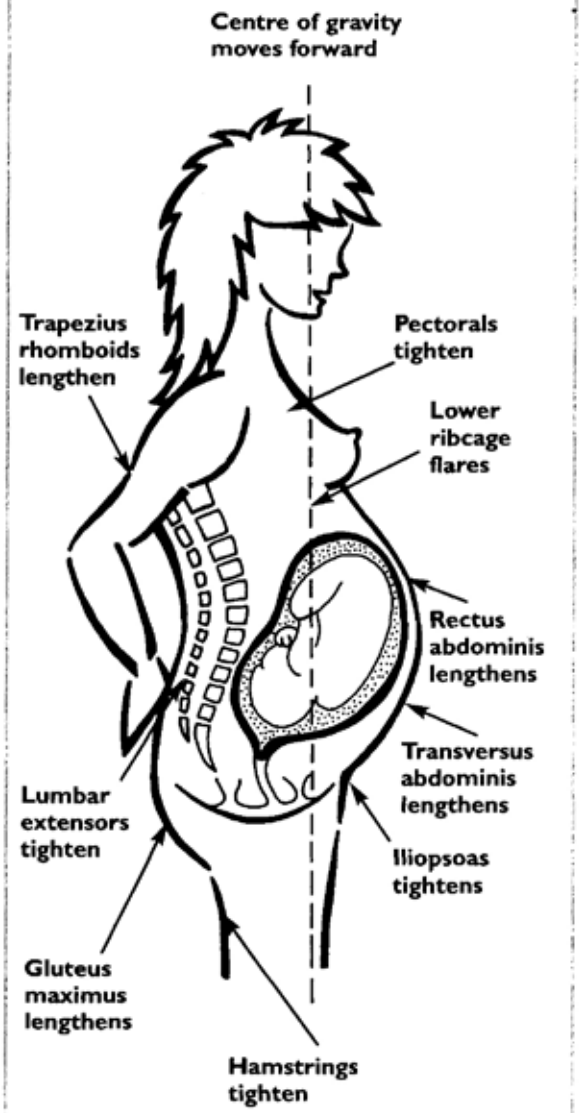
Postnatal posture

The following biomechanical changes are the most commonly observed as a result of pregnancy.

Increased lumbar lordosis:

- Shortening and tightening of iliopsoas and lengthening and weakening of gluteus maximus occur as the sacrum, and sometimes the whole pelvis, tilts anteriorly.
- The facets of lumbar vertebrae become compressed so the hamstrings tighten to draw down the ischial tuberosities in an attempt to protect the spine.
- The hamstrings become overactive and tight as they hang on to the tilting pelvis.

Musculoskeletal and biomechanical changes



- Lumbar extensors shorten and tighten whilst transversus abdominis weakens.
- Rectus abdominis lengthens, weakens and possibly separates.
- Poor functional use of the abdominal wall reduces stability in the pelvis and lower back.

Thoracic kyphosis:

- Shortening and tightening of pectoralis minor occurs with the increased size of the breasts which is further enhanced by poor feeding positions.
- Corresponding lengthening and weakening occurs in trapezius/rhomboids.
- The lower rib cage flares to accommodate the baby.
- Cervical lordosis increases with tilting of head forward.

Postural retraining is crucial to redress the balance of pregnancy-induced changes, and an awareness of correct alignment should be rigorously observed.

Key aims for restoring correct posture

- Re-establish good body alignment.
- Increase core stability.
- Balance opposing muscle groups through strength/stretch.

Correct spinal alignment

Neutral spine is the natural alignment of the spine, i.e. inward curve of the lumbar and cervical vertebrae and outward curve of the thoracic vertebrae. In this position, pressure is equally distributed along the length of the spine, enabling the back to absorb impact whilst minimising stress on bone and soft tissue. When the spine is balanced in neutral, body weight is supported primarily through the bones. Only a very small amount of muscular contraction is needed, from the abdominals and spinal extensors, to maintain equilibrium.

Benefits of neutral spine include:

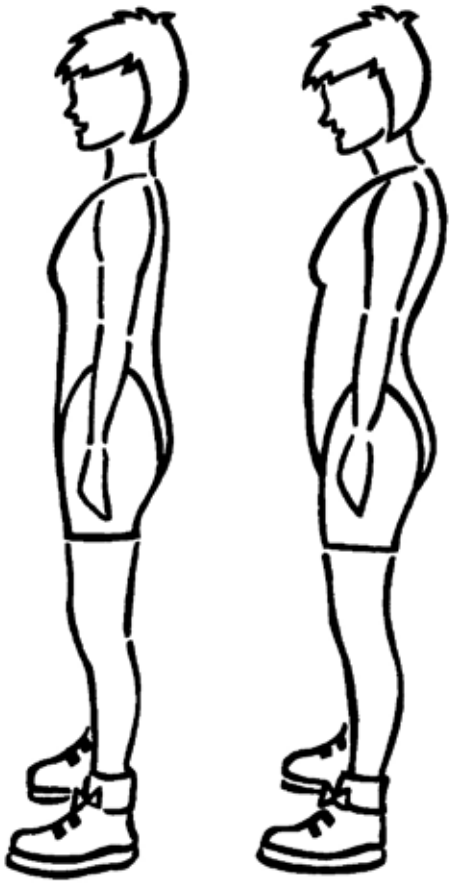
- Improved body mechanics and neuro-muscular efficiency
- Reduction and/or elimination of pain
- Prevention of injury
- Improved circulation
- Improved body shape and a more slender appearance
- Increased flexibility
- Improved co-ordination and sense of balance
- Release of pent-up tensions

Maintaining the spine in a neutral position is extremely difficult for many people. It is often misunderstood and performed incorrectly by over-tilting and eliminating the natural lumbar curve.

Finding neutral spine

Stand with feet hip-width apart and knees soft. Place the heel of your hands on the prominent bones at the front of your pelvis (ASIS) and fingertips on your pubic bone. Tilt the top of the pelvis forward so that your fingertips are lower than the heel of your hand and the natural curvature in your back has increased (anterior pelvic tilt). Now tilt your pelvis the opposite way by lifting your pubic bone upwards so that your fingertips are higher than the heel of your hand (posterior pelvic tilt). Feel your back straightening as the natural curvature disappears. Now find a position midway between these two extremes where your fingertips and heel of hands are on the same vertical plane. Buttocks and front of thighs should be relaxed. This is your correct spinal alignment also known as 'neutral spine'.

Fig. 1.6 **Correct (left) and incorrect (right) posture**



Standing posture

- Stand with the feet hip-width apart (underneath ASIS).
- Spread weight equally between both feet.
- Distribute weight evenly between big toe, little toe and heel.
- Soften the knees and align them over the ankles.
- Find your neutral spine (see above).
- Draw navel through to spine.
- Slide your shoulders down and open the chest.
- Lengthen your tailbone towards the floor.
- Extend your spine towards the ceiling.
- Lengthen the neck keeping the chin parallel to the floor.
- Look straight ahead.

Back care

A new baby makes many new and repetitive demands on the body. Getting in and out of bed for unsociable feeds, bending over to change nappies, securing car seats, and lifting and carrying baby and his accompanying equipment all require the body to work in a variety of physically demanding ways. The spine and pelvis can all too easily be twisted when lowering the car seat into position and securing the seat belt, and the spine can be badly stressed if the large muscles of the legs are not used for bending and lifting. Guidelines for safe practice can be found in the Appendix.

Relaxin and postnatal exercise

The lingering effects of relaxin on joint stability is one of the main risk factors of postnatal exercise. The following areas should be considered.

Range of movement

Care should be taken to protect the joints against injury by ensuring all movements are performed within the regular range of the joint. Speed becomes very important here as fast, particularly long-levered, movements will increase momentum and could easily result in overextension of the joint. Activities such as

Tai-bo, kick boxing, karate etc. may carry an additional risk as the fast, jerky, movements may encourage joint locking or twisting. Studio resistance classes should be avoided by inexperienced participants; skilled individuals may return to the activity once core strength has been regained. Range of movement should be considered with some yoga postures to avoid overextending unstable joints.

Alignment and technique

All movements should be performed with correct body alignment and attention to technical detail. Locking out, or hyperextension, of elbows and knees should be avoided at all times. Neutral spine should be maintained throughout and a tall upright stance adopted where appropriate. Movements involving repetitive joint actions, such as the stepper or cross-trainer, should be kept to a minimum and range adjusted to avoid misalignment of the pelvis. Gym and studio cycling may cause discomfort in symphysis pubis and/or sacroiliac joints if correct seat height is not established. Increased Q angle of the femur may cause knee misalignment during all weight-bearing activities.

Flexibility work

Stretching to increase flexibility should be avoided until 16–20 weeks after the baby is born, or longer if breastfeeding continues. Attempting to take a stretch further than the range of the joint permits could severely compromise joint stability, and the overextension of ligaments may be permanent. Stretching to *maintain* muscle length is strongly recommended and crucial for rebalancing posture. Comfortable stretch positions can be held for longer (up to 30 sec) but no attempt should be made to try and stretch further. Some yoga postures may encourage overextension particularly since they are often held for some time. Care should be taken when participating in this type of activity in the first few months after delivery and instructors should provide alternative postures where appropriate.

High-impact activities

These should also be avoided for the first few months to allow sufficient time for joint and pelvic floor recovery. Lactating breasts will feel uncomfortable and place further stress on their delicate support structures. Pressure on the joints is increased twofold with high-impact activities and puts particular strain on the ankles, knees, pelvis and spine. Jogging is only appropriate if a low-impact stride is practised, minimising vertical action and absorbing the shock through a heel–toe action. Correct knee–hip alignment should also be observed. Experienced runners may need to review their technique.

Resistance training

This relates to the use of resistance equipment in the gym or a studio resistance class. Experienced lifters who continued to train during pregnancy should recommence at the same resistance they were lifting prior to delivery. If resistance training was not undertaken during pregnancy they should recommence at 70 per cent of what they were lifting prior to pregnancy. A heavy weight pulling on an unstable joint has serious implications and should be avoided until the muscles and joints regain strength and stability. A further area of concern with the use of weights is the reduction in core strength and the resulting compromise in postural alignment. It is for this reason that it is not advisable for newcomers to exercise with weights – core

abdominal strength must be established before adding resistance (*see* Chapter 8). Technical teaching is vital, with information about getting into and out of the machine as well as about the exercise itself. Close observation and correction by the instructor should be expected.

Summary

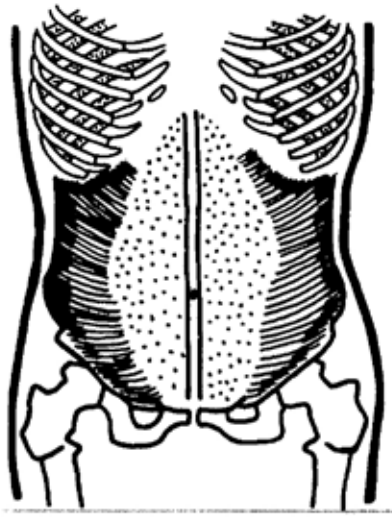
- Relaxin affects the collagen fibres of connective tissue.
- Joints continue to be at risk from the lingering effects of relaxin which caused increased elasticity of the ligaments during pregnancy.
- The effects may continue for up to five months after delivery.
- Joint laxity may persist for longer if breastfeeding.
- The sacroiliac and symphysis pubis joints of the pelvis are particularly vulnerable to injury.
- Posture must be retrained following pregnancy, and essential back care learnt during everyday baby care.
- Neutral spinal alignment should be constantly practised.
- All movements should be performed within the regular range of the joint.
- High-impact activities should be avoided for the first few months after delivery.
- Core stability should be increased before adding resistance.
- Resistance programmes should be endurance-based.
- Overextension of any joint must be avoided.
- Correct joint alignment and exercise technique is vital.
- Flexibility work should be avoided until 16–20 weeks after delivery.

THE ABDOMINAL MUSCLES

Structure of the abdominal muscles

The abdominal muscles are comprised of four layers: transversus abdominis, internal oblique, external oblique and rectus abdominis. These muscles are all interconnected to form a muscular corset.

Fig. 2.1 Transversus abdominis



Transversus abdominis

Transversus abdominis (TrA) is the deepest of the four muscles. Starting in the thoracolumbar fascia of the back, the muscle wraps horizontally around the torso and the two sides insert into a broad tendinous band at the front called an aponeurosis. The aponeurosis of TrA joins with the aponeurosis of the obliques at the midline of the body to form the linea alba. As a result of this insertion TrA plays a significant role in stabilising the linea alba.

The linea alba is a tendinous raphe, seen along the midline of the abdomen between the inner borders of rectus abdominis. It is formed by the blending of the aponeurosis from both sides of the TrA and obliques. It is narrower below than above the umbilicus corresponding with the width of rectus abdominis as it descends.

Contraction of the TrA compresses and flattens the abdominal wall and draws the navel towards the spine. This action also pulls rectus abdominis towards the body and helps to reduce the separation of postnatal abdominals. Together with the obliques, TrA supports the internal organs and stabilizes the pelvis and lower spine. However, since TrA is frequently a very weak muscle it does not automatically contract alongside the other abdominals and must be consciously contracted to make it join in. This has important implications for all abdominal work.

Internal oblique

The internal oblique lies on top of the TrA muscle and forms an inverted V shape. Its origins are thoracolumbar fascia and iliac crest and its fibres run both inwards to the linea alba and upwards to the lower four ribs. As with TrA this muscle feeds into its own aponeurosis which forms part of the linea alba, as described above. The aponeurosis of the internal oblique is particularly significant as it subdivides at the outer edges of the rectus abdominis and passes

Fig. 2.2 Internal oblique

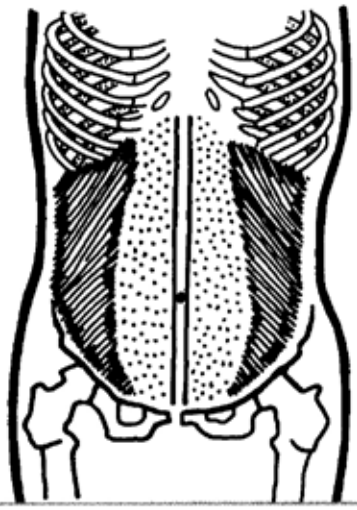
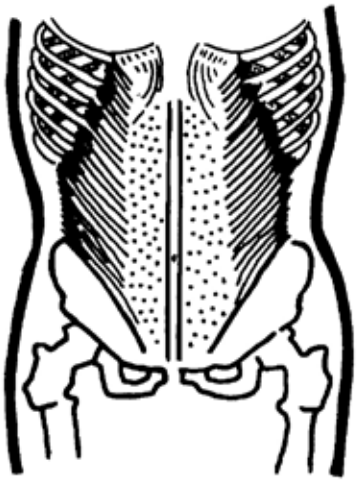


Fig. 2.3 External oblique



in front of and behind the rectus muscle, encasing it within a sheath, before re-joining at the linea alba. This occurs on the upper three-quarters of rectus abdominis only; in the lower quarter of the muscle the three layers of aponeurosis go over the top of rectus abdominis.

Due to the variable direction of its fibres, internal obliques can assist TrA with abdominal compression, flex the trunk to the same side and work with external obliques on the opposite side to provide trunk rotation.

External oblique

The external oblique lies on top of the internal oblique and forms an upright V shape. It originates on the lower eight ribs and runs diagonally and vertically downwards to insert onto the iliac crest. The midline attachment feeds into its own aponeurosis which passes over the top of rectus abdominis and meets with its opposite number in the centre to form the linea alba.

External obliques work together with internal obliques from the opposite side to rotate the trunk. They also assist rectus abdominis with trunk flexion.

Rectus abdominis

The rectus abdominis (RA) forms the uppermost layer of the abdominal muscles. It is

Fig. 2.4 Rectus abdominis

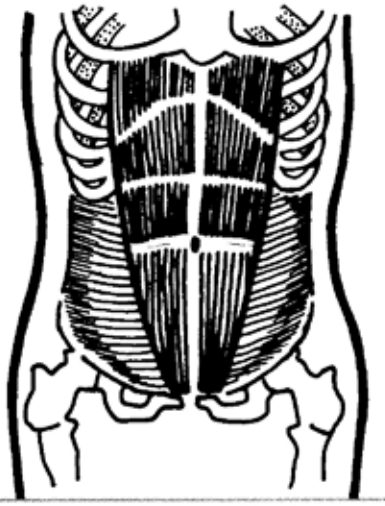
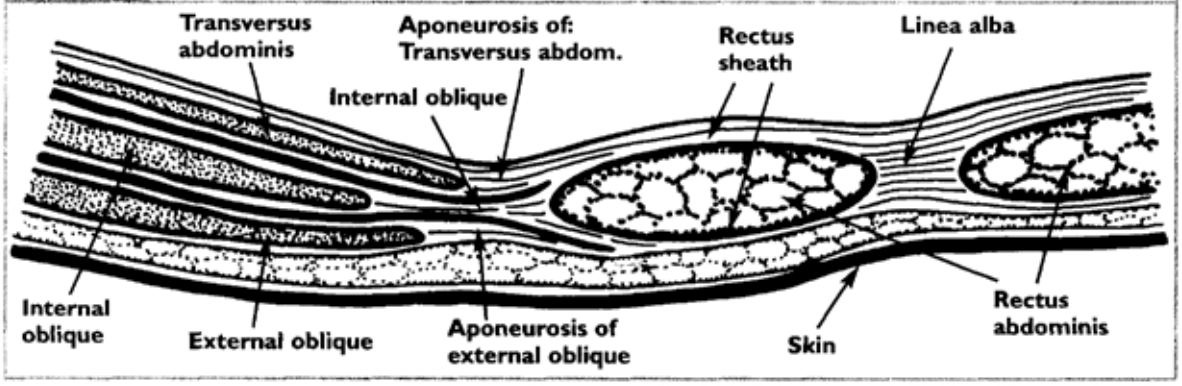


Fig. 2.5 Cross section of abdominal muscles



made up of two bands of muscle which begin on the pubic bone, and travel upwards to attach onto 5th, 6th, and 7th ribs. It is narrower at the bottom and increases in width to approximately 15 cm at the top. The muscle has three fibrous bands, known as tendinous inscriptions, that transverse it, one at the level of the umbilicus and two above it. This has particular relevance when checking for separation of the muscles (*see* page 27) as the area around the umbilicus is most vulnerable. Each side of RA is encased in a sheath made from the aponeurosis of the oblique and TrA muscles. These merge together in the centre to form the linea alba. In the lower quarter of the abdomen, the aponeurosis only covers the top of the recti muscles, which has implications for caesarean deliveries (*see* page 13).

Functions of the abdominal muscles

The abdominal muscles:

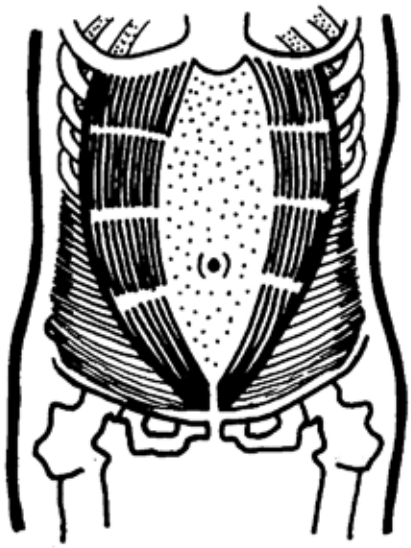
- stabilise and support the lumbar spine;
- support the abdominal and pelvic organs;
- flex the trunk to one side;
- curl the trunk upwards from a lying position;
- rotate the trunk;
- maintain correct pelvic alignment;
- brace the body under stress, e.g. lifting, coughing or sneezing;
- aid expulsive movements, e.g. vomiting, excretion and during the second stage of labour.

Pregnancy and the abdominal muscles

What happens to the abdominal muscles during pregnancy?

Under the influence of relaxin (*see* Chapter 1) the abdominal muscles undergo a tremendous amount of stretching in all directions. Connective tissue within the muscles themselves provides a degree of elasticity, but the main changes occur to the linea alba. The linea alba is connective tissue formed by the joining of the aponeurosis of the TrA and oblique muscles. Relaxin increases the water content of collagen fibres found within connective tissue, resulting in increased elasticity of the linea alba in both directions. The waistline may increase by approximately 50 cm (20 in) and rectus abdominis may lengthen by approximately 20 cm (8 in). The

Abs during pregnancy



two bands of recti muscle which previously lay parallel stretch away from the midline to allow more space for the growing uterus (*see* Figure 2.6). This is known as diastasis recti – separation of the recti muscles – and is quite common, occurring in 66 per cent of women in the third trimester. Actual separation is not painful and many women will be unaware that it has happened, although they may have chronic backache due to lack of support from the abdominal muscles (*see* Chapter 5).

Stretch weakness

Stretch weakness occurs when a muscle remains elongated, beyond its normal resting position but within its normal range (Kendall et al. 1993). In this position, its contractile ability is reduced as the actin and myosin filaments are taken too far apart to contract. The muscle adapts by adding another sarcomere to the end of the muscle which pushes the contractile elements closer together.

This change occurs in rectus abdominis as it stretches over the pregnant uterus and results in weakness within the muscle's inner range (Norris 2000). Postnatally, muscle length will gradually reduce but can be speeded up by inner-range training (*see* page 26 for suitable exercises).

What happens to the abdominals during a caesarean section?

Trauma to the abdominal muscles during a caesarean section is not as severe as many women believe; the muscles themselves are not cut. An incision of approximately 10 cm is made just above the pubic bone which cuts through the rectus sheath and the two sides of the rectus muscle are drawn apart. As there is only one layer of aponeurosis in the lower portion of the abdomen, once the muscles have been separated sufficient space is created to proceed with the delivery. After the baby has been lifted out, the rectus sheath is repaired and the muscles realigned.

Is it more difficult for the muscles to recover after a caesarean?

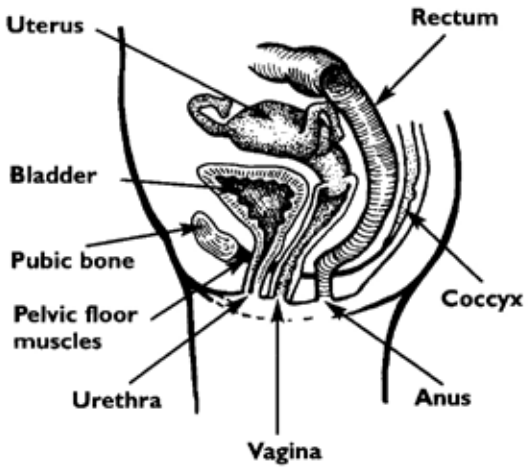
Most women who deliver by caesarean section feel that abdominal recovery is inhibited by the procedure. Although the muscles themselves have not been cut, the layers of aponeurosis have; contraction of TrA may cause pain or discomfort that may inhibit effective engagement. Exercises for TrA should be encouraged as soon as possible and progressed slowly, provided no pain is felt. Trapped air, as a result of surgery, may add to the problem in the first couple of days post-delivery. This can be assisted by performing pelvic tilts in a supine position. Tingling and numbness will be experienced around the scar site, with sensation returning in patches; full sensory recovery could take up to six months.

THE PELVIC FLOOR

The structure of the pelvic floor

The pelvic floor is a muscular platform at the base of the pelvis. Formed by a combination of muscles and fascia it resembles a sling, attached to the walls of the pelvis from the pubic bone at the front to the coccyx at the back. It consists of two halves joined in the middle to allow the urethra, vagina and anus to pass through. Superficial muscles form a figure 8 around these openings. The pelvic floor comprises four layers:

Fig. 3.1 **Side view of pelvic floor muscles**



1 A layer of fascia made of fibromuscular tissue consisting of collagen, elastin and smooth muscle fibres which surrounds and suspends the pelvic organs. This fascia provides limited support but requires the assistance of the pelvic floor muscles (PFM) when under pressure.

2 Levator ani muscle group consists of three muscles, formed in pairs, which attach in the middle and interconnect with the layers of fascia above and below. They form a muscular platform through which the urethra, vagina and anus pass.

3 The perineal membrane is made of collagen fascia and lies directly below the levator ani muscles. It provides support when the levator ani muscles relax.

4 Superficial muscles consist of three small muscles arranged in a figure of 8 around the openings. They offer minimal assistance to the continence mechanism and a small amount of support.

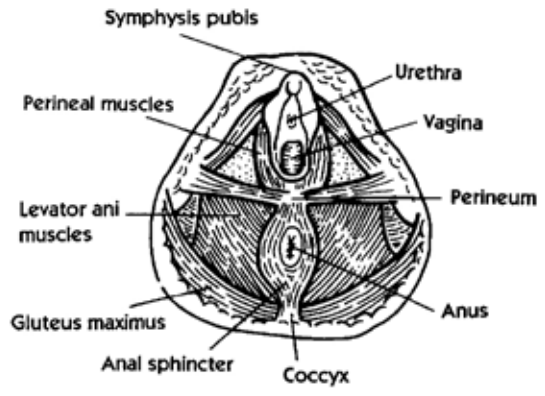
Slow- and fast-twitch muscle fibres

Skeletal muscle contains both slow- and fast-twitch muscle fibres and the PFM are no exception. The slow-twitch fibres work

Fig. 3.2 **Levator ani muscles**

constantly at a low level to support the pelvic organs and maintain continence. They are slow to fatigue. The fast-twitch fibres have the ability to produce immediate strong contractions around the bladder neck and urethra to counteract sudden rises in intra-abdominal pressure – the cough reflex. These muscle fibres are quick to fatigue. Both types are found in the levator ani muscles (Jozwik and Jozwik 1998). The normal pattern of recruitment begins with slow-twitch fibres followed by fast, as additional strength is required, but during coughing or sneezing this pattern is reversed (Johnson 2001).

Fig. 3.3 **Superficial muscles of the pelvic floor**



Functions of the pelvic floor

- To support the organs of the pelvis (bladder, uterus and bowel) and maintain their optimum angle.
- To resist sudden rises in intra-abdominal pressure such as coughing, sneezing, lifting and straining.
- To play a significant role in the continence mechanism.
- To help rotate the baby's head during delivery.
- To increase sexual satisfaction.
- To co-activate with TrA to assist pelvic-spinal stability.
- To have an inhibitory effect on bladder activity.

Mechanics of continence

During sudden rises in intra-abdominal pressure, the PFM contract and lift the bladder neck higher into the abdominal cavity. This reinforces urethral closure pressure and prevents urine escaping (Sapsford et al. 1998). Studies by King et al. (1998) suggests that pregnancy and birth affect bladder neck mobility and PFM exercises elevate the bladder neck and assist in the continence mechanism.

Changes to the pelvic floor during pregnancy

Increased levels of relaxin produced during pregnancy are believed to affect the two layers of fascia which encase levator ani, and weaken the whole support mechanism. Research suggests that it is pregnancy, rather than childbirth itself, which has the greatest effect on the PFM, with 64 per cent of women developing incontinence symptoms during this time (Charelli and Campbell 1997). It is thought that one of the contributory factors may be increased mobility in the bladder neck, decreasing support and reducing the closing pressure, creating leaks.

Collagen make-up determines the strength of the PFM, therefore a woman who experiences severe stretch marks, or is hypermobile is very likely to have problems with her PFM.

Additionally the uterus, which is not a fixed organ, is suspended by ligaments and therefore relies on the pelvic floor for the majority of its support. The increasing weight of the pregnant uterus places additional and progressive pressure on the weakening pelvic floor, putting it severely at risk. It is not uncommon for women to suffer stress incontinence (*see* page 40) in late pregnancy because of these changes.

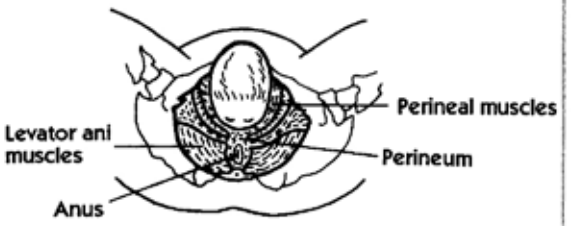
Effects of labour and delivery on the pelvic floor

During labour and delivery the Levator ani muscles must relax to allow the baby to descend down the birth canal. It provides a pathway to guide the baby's head downwards, and strong muscles will help the baby to turn. Although relaxin has increased its elasticity, the PFM and superficial perineum still have a tremendous amount of stretching to do in the second stage of labour as the outlet area is forced open. If the baby's progress down the birth canal is very quick, and the perineum has insufficient time to stretch adequately, or the perineum and PFM lack sufficient elasticity to stretch over the baby's head, they may tear.

Fig. 3.4 Levator ani muscles during delivery

Trauma to the perineum may occur through tearing, episiotomy, swelling or bruising.

Fig. 3.5 Effects of labour and delivery on the pelvic floor



Episiotomy

An episiotomy is an incision in the perineum to enlarge the vaginal opening. It is performed to avoid excessive tearing or to speed up the delivery, usually if the baby is distressed. An episiotomy is also used in conjunction with an assisted delivery such as forceps, as it allows more space for the use of instruments in the vagina.

Stitches

If the perineum has been cut in an episiotomy, or a tear continues to bleed, it will be repaired with stitches. Healing usually occurs within 10 days, but it may take up to six weeks for stitches to dissolve.

Caesarean delivery

Many women who deliver by caesarean section do not appreciate the need to continue PFM exercises. Although these muscles have not experienced the excessive stretching and trauma of a vaginal delivery, relaxin has still increased its elasticity and the muscles have supported the growing baby for nine months.

As previously mentioned, studies have indicated that it is pregnancy rather than labour that is the cause of stress incontinence, so the case for pelvic floor exercises is still strong regardless of the type of delivery.

Stress incontinence

Stress incontinence is the involuntary loss of urine during physical exertion, i.e. coughing, sneezing, straining, lifting or jumping. It is not uncommon after childbirth and is often associated with:

- Overstretching of one or more of the muscle layers, decreasing organ support.
- Increased bladder neck mobility.
- Overstretching of the pudendal nerve responsible for activating the PFM. Damage to this nerve will affect the ability of the muscle to contract. This is usually associated with a difficult labour, especially forceps delivery.
- Forceps deliveries – Kessel et al. (2001) suggest a tenfold increase.

Unfortunately many women believe it is a natural consequence of having children and accept the condition. If exercises are not commenced or professional advice not sought the muscles will deteriorate and increase the risk of short- and long-term complications. A regular programme of correctly performed PFM exercises may resolve this problem; if not, referral to a physiotherapist specialising in women's health may be necessary.

Pelvic floor repair

The perineum may feel very sore and uncomfortable for many days after delivery, and it may be difficult to find a comfortable sitting position. The idea of exercising that area may cause concern about damaging it further. Despite apprehensions, gentle exercise will actually promote healing and aid recovery. During muscular contraction, blood flow to the area is increased, bringing with it nutrients for tissue repair and removing waste products. Exercises will reduce the pain and discomfort experienced from a swollen and tender perineum, and assist the edges of a cut/tear to close together.

When should pelvic floor exercises commence?

PFM exercises (PFME) should begin as soon as possible after the baby is born, ideally whilst still in the delivery room! If they are not undertaken the muscles will remain stretched and become further weakened with daily activities; recovery will then be much more difficult. Women who have never performed a PFME may experience difficulty in learning the process after delivery, as the muscles are stretched and weak and the response to their contractions so poor that nothing at all is felt. Recent research (Sapsford et al. 2001) suggest that PFM co-contract with TrA and vice versa. This is a useful starting point for women who find these exercises difficult or uncomfortable to do but should not be relied on as the only method of training. PFME must still be performed.

Effective teaching

It is advisable to spend time explaining the structure and function of the PFM before exercises are commenced. Launching straight into the exercises with no prior information will reduce their effectiveness. Whilst women will have been instructed to do these exercises after the birth, they may not be aware of their