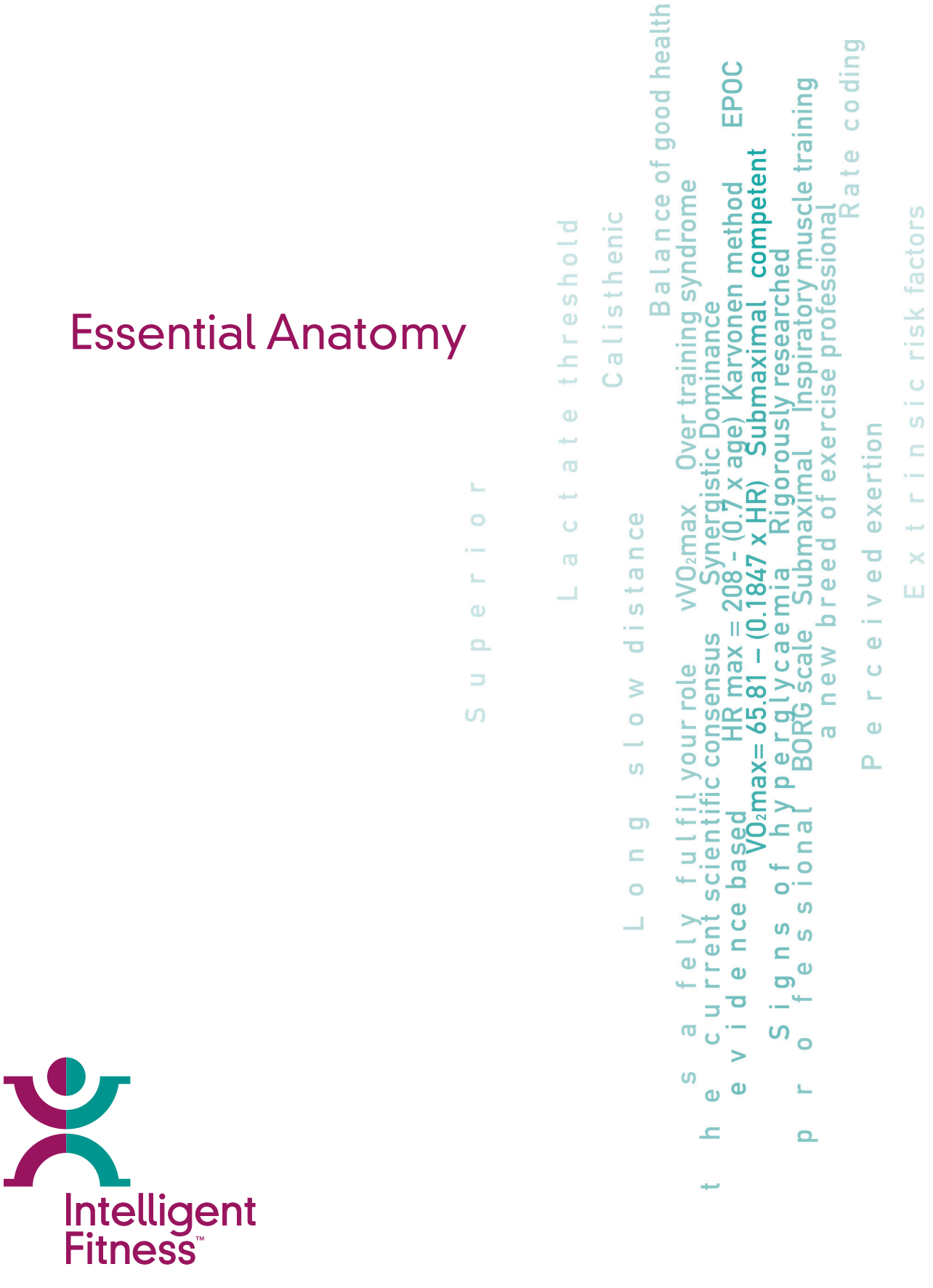
Essential Anatomy



Intelligent Fitness™

Dear Student

Welcome to Essential Anatomy for Exercise Professionals.

The purpose of this module is to provide the student with a sound understanding of kinesiology and anatomy, in particular musculoskeletal anatomy.

This understanding is essential for any exercise professional aspiring to fulfil the increasingly demanding role required by much of the public.

This module has been written to provide you with a reference source and to add structure to your study, which is essential if you are to gain a thorough understanding of the subject.

This module may be used on its own, however, the best results will be achieved by also attending any corresponding Intelligent Fitness training days.

I trust you will find this module worthwhile.

David Wells

Principal Intelligent Fitness Trainer

Multifidus

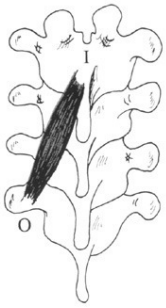
A deep intersegmental muscle, multifidus plays an important role in lumbar stability, its fibres are arranged segmentally, in three layers each with its own nerve innervation.

Attachment

- The sacrum, TLF, the transverse process of the lumbar, thoracic and lower 4th or 5th cervical vertebrae

Attachment

- Deepest layer: The spinous process of the vertebrae immediately above
- Middle layer: The spinous process of the vertebrae 2 or 3 above
- Outer layer: The spinous process of the vertebrae 3 or 4 above



Action

- Bilaterally: Extension of the spine
- Unilaterally: Ipsilateral flexion of the spine
- Unilaterally: Contralateral rotation of the spine
- Works as an extensible ligament, stabilising adjacent vertebrae, throughout movements of the trunk
- Contributes 70% of the segmental stiffness resulting from muscle contraction

Wlike et al (1995) cited by Norris (2008)

- Produces posterior sagittal rotation (rocking) of the lumbar vertebrae, this controls lordosis at the vertebral level and neutralises the flexion caused when the obliques rotate the trunk.

Macintosh and Boduk (1986) cited by Norris (2008)

- Multifidus is active through the whole range of flexion, during rotation in either direction, and during extension movements of the hip.

Valncia and Munro (1985) cited by Norris (2008)

In individuals with low back pain (LBP) the cross sectional area of multifidus has been shown to be reduced on the ipsilateral side to the symptoms and the vertical level corresponding with the symptoms.

Hides et al. (1994) cited by Norris (2008)

In addition to the asymmetry resulting from the atrophy, LBP often results in a reduced ratio of slow twitch to fast twitch muscle fibres; this is common when low back pain has resulted in a reduction in physical activity.

Biedermann et al. (1991) cited by Norris (2008)

A return to normal multifidus function does not automatically occur when pain is resolved and normal activity is resumed. The most effective approach to retraining multifidus has been shown to be a combination of medical treatment and specific exercise therapy.

Norris (2008)

Movements and Joints of the Cervical Spine

When discussing movement of the head on the neck and movement of the neck, it is important to remember that these movements occur between the skull and the first and second vertebrae as well as within the cervical spine.

The movements available are:

- Flexion
- Extension
- Lateral flexion (reduction)
- Rotation

Between adjacent vertebrae there are three joints, which together are referred to as the articulating triad. The triad comprises the intervertebral disc, which provides the main joint between the movable vertebral bodies, and two facet joints.

The zygapophyseal joints (facet joints) are synovial joints that are found on all of the moveable vertebrae, they allow the movements of flexion, extension, lateral flexion and rotation.

There are also two distinct joints in the cervical spine:

- The atlanto-occipital joint
- The atlanto-axial joint

The atlanto-occipital joint

The atlanto-occipital joint is formed by the occipital condyles of the skull sitting on the articular fossa of the atlas (first cervical vertebrae).

Primarily the atlanto-occipital joint allows flexion, extension and lateral flexion. There is also a slight slipping between the skull and the atlas which constitutes a form of rotation.

The atlanto-axial joint

The atlas (C1), a ring of bone, sits on the dens, a peg like process of the axis (C2), to form the atlanto-axial joint, which is classified as a pivot or trochoid joint.

The principle movement occurring at this joint is rotation, with perhaps a few degrees of flexion and extension being possible.

Normal Ranges of Movement of the Cervical Spine			
Movement	**Region of the Cervical Spine**		**Range of Movement (degrees)**
Flexion	Upper	AO	10
		AA	slight
	Lower		25
Extension	Upper	AO	10
		AA	slight
	Lower		85
Lateral flexion	Upper	AO	8
		AA	0
	Lower		40
Rotation	Upper	AO	slight
		AA	15
	Lower		50

AO = Atlanto-occipital joint
AA = Atlanto-axial joint

Palastanga (2006)

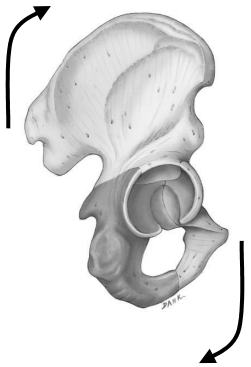
Musculature Control and Stabilisation of the Pelvis

Having discussed many of the muscles of the pelvic region individually, it becomes apparent that any muscle that attaches to the pelvis has some degree of influence over its orientation in one or more planes.

Muscles tilting the pelvis anteriorly

The pelvis can be tilted anteriorly by the concentric action of muscles that pull down anteriorly and those that pull up posteriorly. When working isometrically these same muscles will resist posterior tilting.

- Erector spinae
- Quadratus lumborum
- Latissimus dorsi

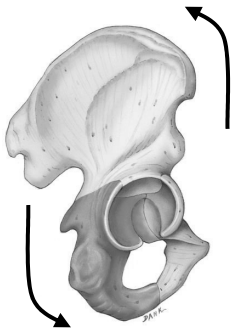


- Iliacus
- Rectus femoris
- Sartorius
- Tensor fascia latae

Muscles tilting the pelvis posteriorly

The pelvis can be tilted posteriorly by the concentric action of muscles; that pull up anteriorly and those that pull down posteriorly. When working isometrically these same muscles will resist anterior tilting.

- Rectus abdominis
- External obliques



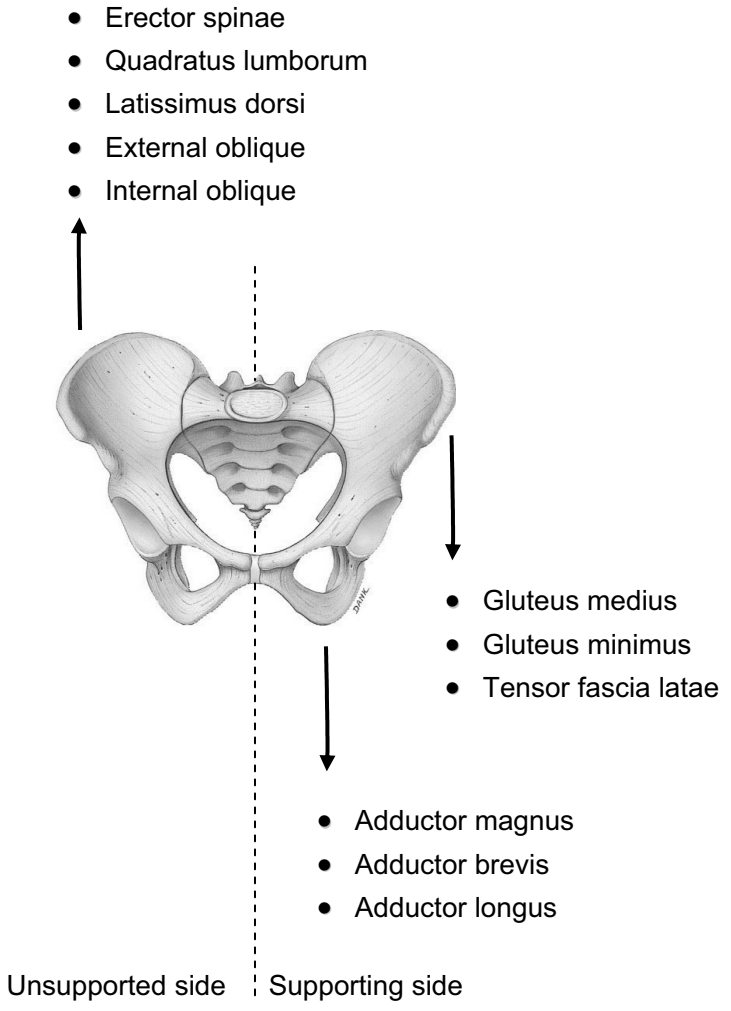
- Gluteus maximus
- Semimembranosus
- Semitendinosus
- Biceps femoris

Adapted from Kendall (2005)

Muscles stabilising the pelvis laterally

When standing on one leg, the pelvis must be stabilised laterally, to prevent the unsupported side from dropping. This is achieved by the contraction of both the abductors and the adductors on the supported side. The abductors exert a downward pull on the ilium, whilst the adductors pull downward on the pubis. Together these actions balance the pelvis on top of the femur of the supporting leg.

The contralateral flexors of the spine that have attachments onto the pelvis, assist by exerting an upward pull on the opposite side of the pelvis.



Adapted from Kendall (2005)

When the legs are off the ground, as in side lying, the pelvis must be stabilised laterally by the action of the lateral trunk flexors alone.

Gluteus maximus' control and stabilisation of the pelvis

Due to its attachments between the thoracolumbar fascia (TLF), the pelvis and the femur, gluteus maximus is capable of controlling the position of the pelvis relative to the femur and the lumbar spine. This control allows it to stabilise the pelvis in a number of ways.

It influences the vertical orientation of the trunk by rotating the pelvis posteriorly on the femoral head during weight bearing.

Elphinston (2004)

Gluteus medius' control and stabilisation of the pelvis

When the femur is fixed, as in standing, gluteus medius is the primary stabiliser of the pelvis in the lateral plane. Gluteus medius contracts to hold the pelvis level horizontally, thus allowing the trunk to orientate itself vertically above the pelvis.

When standing on one leg, the maintenance of a horizontal pelvis requires the activation of gluteus minimus, tensor fasciae latae and the adductors of the hip, to assist gluteus medius.

Elphinston (2004)

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