Section 3 - Part 3: Posture

• Definition and introduction

➢ Muscle imbalances are ultimately reflected in posture. Posture can be defined as the attitude or position of the body (Thomas, 1997) and according to Martin (2002), should fulfil three functions:

▪ it must maintain the alignment of the body’s segments in any position: supine, prone, sitting, quadruped, and standing.

▪ it must anticipate change to allow engagement in voluntary, goal-directed movements such as reaching and stepping.

▪ it must react to unexpected perturbations or disturbances in balance.

➢ From the above, it can be seen that posture is an active as well as a purely static state and that it is synonymous with balance. Optimal posture must be maintained at all times when holding static positions (sitting, standing) but also during movement.

➢ If optimal posture and postural control is to be encouraged during exercise performance the principles of good static posture must be fully appreciated. Once this is understood poor posture can be identified and corrective strategies adopted.

➢ “Good posture is the state of muscular and skeletal balance that protects the supporting structures of the body against injury or progressive deformity irrespective of the attitude (e.g. erect, lying, squatting, stooping) in which these structures are working or resting.” Posture Committee of the American Academy of Orthopaedic Surgeons (1947).
“Poor posture is a faulty relationship of the various parts of the body, which produces increased strain on the supporting structures and in which there is less efficient balance of the body over its base of support”. Posture Committee of the American Academy of Orthopaedic Surgeons (1947).

**Flat back**

- Forward head - short upper traps / SCM
- Long mid traps / rhomboids
- Long erector spinae
- Short gluteus maximus / hamstrings
- Ankle plantar flexion
- Short plantar flexors
- Long neck flexors
- Short pecs / lats
- Short abdominals
- Long hip flexors
- Knee flexion or extension

**Hollow back**

- Forward head - short upper traps /
- Long mid traps / rhomboids
- Short erector spinae
- Long gluteus maximus / hamstrings
- Ankle plantar flexion
- Short plantar flexors
- Long neck flexors
- Short pecs / lats
- Long abdominals
- Short hip flexors
- Hyperextension of knee
• **Causes of poor posture**
  - These would include physical trauma, congenital or acquired deformity within the musculoskeletal system or some form of faulty loading pattern (FLP). Faulty loading patterns may occur in everyday life or may be seen and even encouraged in the sporting or fitness arena.

• **Implications of poor posture**
  - **(1) Impaired movement:** Sahrmann (2002) identifies the main causes of deviations in joint movement patterns as repeated movements and sustained postures associated with daily activities of work and recreation. So poor posture, whether static (a sustained posture) or dynamic (as expressed in repeated movements) will induce changes in the components of the movement system.
    - This is particularly relevant to the fitness and sporting arena where sustained postures and repeated movement patterns are the norm.
    - **Example of the possible effects of sustained postures:** it has been shown that cyclists who spend 3 hours riding their bicycles in a position of lumbar flexion have a reduced lordosis in the lumbar spine when compared to a control group who did not ride bicycles (Sahrmann, 2002). So, in this case, the maintenance of a sustained posture necessitated by the requirements of a sport has directly altered posture in the longer term. This will in turn affect movement, since such an individual is poorly prepared to maintain a neutral spine during lifting...
movements and is likely to migrate to their position of strength (i.e. lumbar flexion) during such movements.

- As regards repeated movements resistance training is wholly based on repetitions. All personal trainers would recognise that this can bring beneficial effects for muscles and movement performance. However, it should be equally obvious that if that if exercises are poorly chosen or performed they may well induce undesirable changes in the movement components.

- **Example:** an office worker with chronic shortening of the latissimus dorsi muscles, who is unable to raise the arms above the head without overextending the lumbar spine, but is repeatedly, given overhead pressing movements in the gym. Lumbar spine dysfunction and pain is, the almost inevitably, result.

- Machine-based resistance training particularly, predisposes the exerciser to a build up of micro-trauma within the musculoskeletal system. This is because each repetition is performed in a fixed path and so is identical. This will repeatedly stress the same structures thereby increasing the chances of possible overuse injury and pain. This constant repetition of exactly the same movement and the subsequent problems it can create is referred to as **pattern overload**. In contrast, each repetition with free weights is slightly different thereby reducing the likelihood of pattern overload.

- (2) **Pain:** In good posture the postural muscles are fairly inactive and energy efficient, only responding to disruptions in balance to maintain an upright position. In contrast, as the body moves away from ideal alignment postural muscle tone increases, leading to greater energy expenditure.

- **Muscle ischaemia** will be a primary source of pain in the initial stages of poor posture. The blood flow through a muscle is inversely proportional to the level of contraction or activity, reaching almost zero at 50-60% of contraction force (Sjogaard 1988). Sjogaard’s studies also indicated that the body could not maintain homeostasis with contractions over 10%.

- The weight of the head is 7% (shoulders and arms are 14%) of the total body weight. This means that in an 80kg man the head will weigh around 5 to 6kg. If, in poor posture, the head and shoulders move forward, out of ideal alignment, the activation of the neck extensors will increase dramatically resulting in restricted blood flow. The prolonged isometric contraction will force the muscles into anaerobic metabolism and increase the accumulation of lactic acid and other irritating metabolites. If this is not addressed, it may initiate a further reflex contraction of the already hypertonic musculature. The unfortunate individual has now entered the **pain spasm cycle**.
Key point: Correction of poor posture relies on the identification and correction of existing muscle imbalances. A greater awareness must also be generated amongst clients as to what good and bad posture is in order to fully involve them in the correction process.

• Force couples and postural deviations

Force couple definition: A situation where two forces of equal magnitude, but opposite direction, are applied to an object and pure rotation results (Abernethy et al, 1996).

Some examples of force couples are illustrated below. These force couples work together to ensure good length-tension relationships within muscles, efficient joint mechanics and the effective integration of the sensory and motor aspects of the nervous system.

Faced with poorly sustained postures or movement patterns, force couples will also become dysfunctional. One force couple may dominate over another, resulting in a shortening of the involved muscles and a lengthening of their antagonists. Poor length-tension relationships develop in the muscles which in turn will produce poor joint mechanics. Similarly, one muscle group may dominate over another within a force couple again producing imbalance and dysfunction.

Key point: Knowledge of force couples is key to an understanding of posture and movement.
• Anteroposterior pelvic force couples

- **posterior pelvic tilt**
  - rectus abdominis
  - external obliques
  - gluteus maximus
  - hamstrings

- **anterior pelvic tilt**
  - erector spinae
  - quadratus lumborum
  - iliopsoas
  - rectus femoris

• Sagittal postural deviations (Kendall, 1993)

- **Flat back posture**

  - **Head:** Forward
  - **Cervical:** Slightly extended
  - **Thoracic:** Lower part straight / upper flexed
  - **Lumbar:** Flexed (straight)
  - **Pelvis:** Posterior tilt
  - **Hip:** Extended
  - **Knee:** Extended (or flexed)
  - **Ankle:** Slight plantar flexion

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*Weak / Elongated:*
- Iliopsoas
- Back extensors
  (may not be weak)

*Short / Strong:*
- Hamstrings
- Abdominals
Hollow back posture

Head: Forward
Cervical: Hyper-extended
Scapulae: Abducted
Thoracic: Hyper-Kyphosis
Lumbar: Hyper-Lordosis
Pelvis: Anterior tilt
Hip: Flexed
Knee: Slightly Hyper-extended
Ankle: Slight plantar flexion

Weak & Elongated:
  - Neck flexors
  - Upper back
  - Hamstrings
    (may not be weak)
  - Obliques

Short & Strong:
  - Neck extensors
  - Hip flexors
  - Lower back
    (may not be short)

Sway back posture

Head: Forward
Cervical: Slightly extended
Thoracic: Flexion (Kyphosis)
Lumbar: Flattened (flexion)
Pelvis: Posterior tilt
Hip: Hyper-extended & forward
Knee: Hyper-extended
Ankle: Neutral (pelvis deviation)

Weak & Elongated:
  - Iliopsoas
  - Obliques
  - Upper back extensors
  - Neck flexors

Short & Strong:
  - Hamstrings
  - Lower back (not short)
  - Upper abdominals