POSTURE: PART 1

This is the first of two articles by physiotherapist Chris Norris, who looks at the importance of posture in clinical practice. In Part 1, he looks at optimal posture, how to assess posture in the clinical environment and the types of suboptimal posture. In Part 2 he goes on to examine methods to correct suboptimal posture using soft tissue therapy and exercise.

BY CHRIS NORRIS, MCSP, PHD

POSTURE ASSESSMENT

Clinical importance of posture

Many practitioners consider posture to be important, and as early as 1947 the Posture Committee of the American Academy of Orthopaedic Surgeons defined posture as "the arrangement of body parts in a state of balance that protects the supporting structures of the body against injury or progressive deformity". This succinct definition highlights the most important aspects of posture: first, that it is an arrangement of body parts to create balance; and second, that if this balance is lost, then it is likely to have clinical implications.

When posture is optimal, there should be no pain and little muscle work needed to maintain it. Indeed, optimal posture combines both minimal muscle work and minimal joint loading. Where posture becomes suboptimal, we can expect both of these factors to increase. Figure 1 illustrates this. Blocks are arranged along a central line that passes through the centre of each block, in the same way that body segments are arranged along the posture line passing from the top of the head to between the feet. If one block moves forwards, its centre moves away from the line, causing it to tilt or fall. To prevent this, something must pull the block back in the opposite direction. In the case of the body, this opposite pull comes from soft tissues, especially muscle, meaning that the amount of muscle work is significantly increased. This is an immediate effect, but over

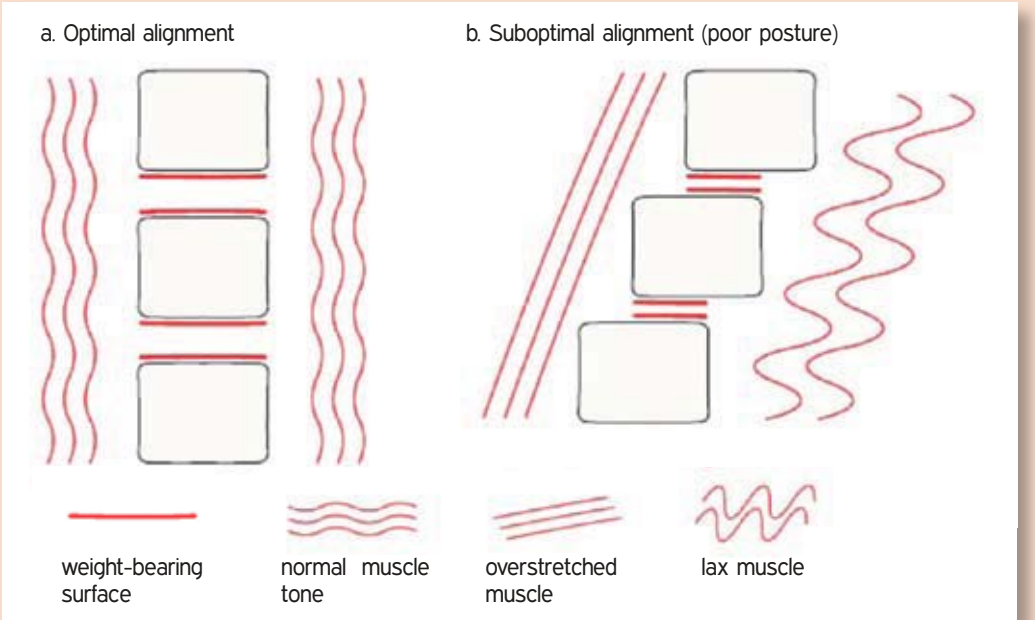

Figure 1: Impact of suboptimal posture

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time tissue adaptation will occur, with some tissues shortening and others lengthening. Soft tissue imbalance must therefore be corrected as part of posture re-education.

In addition, when one block lies directly on top of another, its weight is distributed evenly along its whole contact surface. If one block moves forward relative to another, its weight is the same but this weight will be distributed over a smaller surface. The result is an increase in pressure (compression force) – just like a shoe with a stiletto heel causing more pressure on a floor than a shoe with a broader heel. Increased pressure gives increased loading and damage may result over time, as we saw with dance floors becoming pock-marked by stiletto heels in the 1960s.

Minimising joint loading over time is important. Joints rely on intermittent loading to flush nutrients contained within the synovial fluid across the joint surface and press them into the hyaline cartilage. Constant loading does not achieve the same effect, and point pressure caused by malalignment of a joint can produce thinning and degenerate in joint cartilage. Correcting malalignment spreads pressure over a larger area, and restrengthening poor muscle increases the support to a joint. This effect (called load-sharing) takes some of the stress imposed on to a joint away from the joint structures such as cartilage, bone and ligaments and on to the muscles.

ASSESSING POSTURE IN THE CLINIC

Posture may be labelled static (still) or dynamic (moving). Static posture looks at one body segment relative to another along a vertical posture line. This type of assessment uses a plumbline and/or posture chart (Figure 5) and can suggest areas where further testing is required. For example, shortened tissue may develop trigger points requiring more attention by a soft tissue therapist. Dynamic posture also gives information about body segment alignment, muscle actions and motor skill. In the clinic we are mainly interested in walking, bending and sitting. In sport, actions such as running, jumping and throwing are examples of clinically important dynamic postures. A keen clinical eye may be used to view dynamic posture, but the speed of an action makes the use of video and computer systems attractive and the cost of these systems is reducing all the time.

> "TISSUE ADAPTATION WILL OCCUR, WITH SOME TISSUES SHORTENING AND OTHERS LENGTHENING"

Figure 2: Optimal posture – the lip of the pelvis forms a near-vertical line with pubic bone in the groin

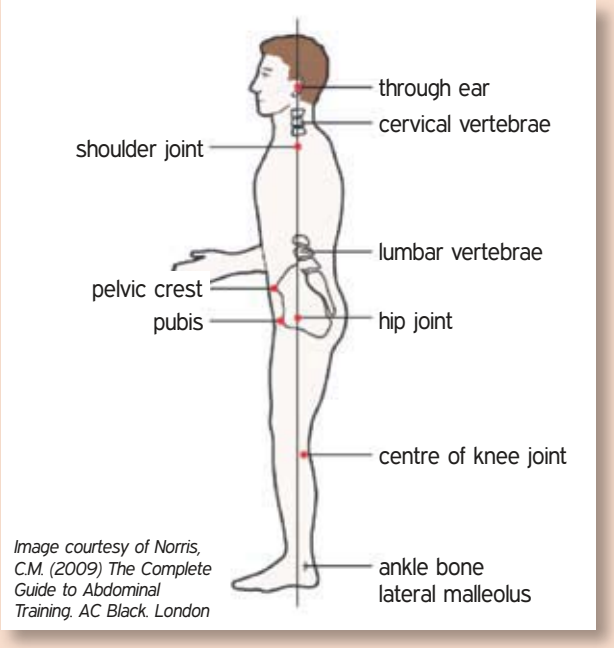

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Figure 3: Skyline view to see rib position

Static posture assessment

Static posture assessment begins with the subject standing behind a plumbline or posture screen. From the side the line should pass just in front of the ankle bone (lateral malleolus), just in front of the centre of the knee joint, through the greater trochanter of the hip, and then through the bodies of the lumbar vertebrae and the centre of the shoulder joint and ear (Figure 2). By passing through the knee joint centre, the knee is pressed straight and locks (extensor torque), meaning that we do not require any muscle activity in our quadriceps to stay standing upright. If the knee moves forwards, the line passes behind the knee centre, giving the knee a tendency to bend and unlock (flexor torque); this action must be resisted by activity in the quads. This muscle activity has two effects: first, it is tiring over time; second, the patella is pressed on to the patellar surface of the femur below, which can worsen the condition in a patient with patellofemoral pain.

The position of the greater trochanter, pelvis and lumbar spine is important for low back pain. Postural changes can increase or reduce the depth of the lumbar curve (lordosis), changing disc pressure and facet joint loading within the lumbar spine. We look more closely at this effect in Part 2 of this series.

The shoulder should lie on the posture line, but commonly it is pulled forwards due to slouching in sitting and driving postures in daily life. This body position can lead to tightness in the anterior shoulder and chest muscles. A forward-lying shoulder posture can also be the result of increased curvature of the thoracic spine, forward tilting of the scapula, or anterior shift of the head of the humerus (ball) within the glenoid cavity at the shoulder joint (socket).

From behind, the posture line should bisect the body into two symmetrical halves. From the ground, the spread of the heel tissue and height of the foot arches should be equal. Many foot conditions require the use of orthotic supports to change foot alignment, and foot exercises to strengthen the foot musculature are an often forgotten aspect of fitness. Calf bulk should be the same on each side, with the knee creases level and

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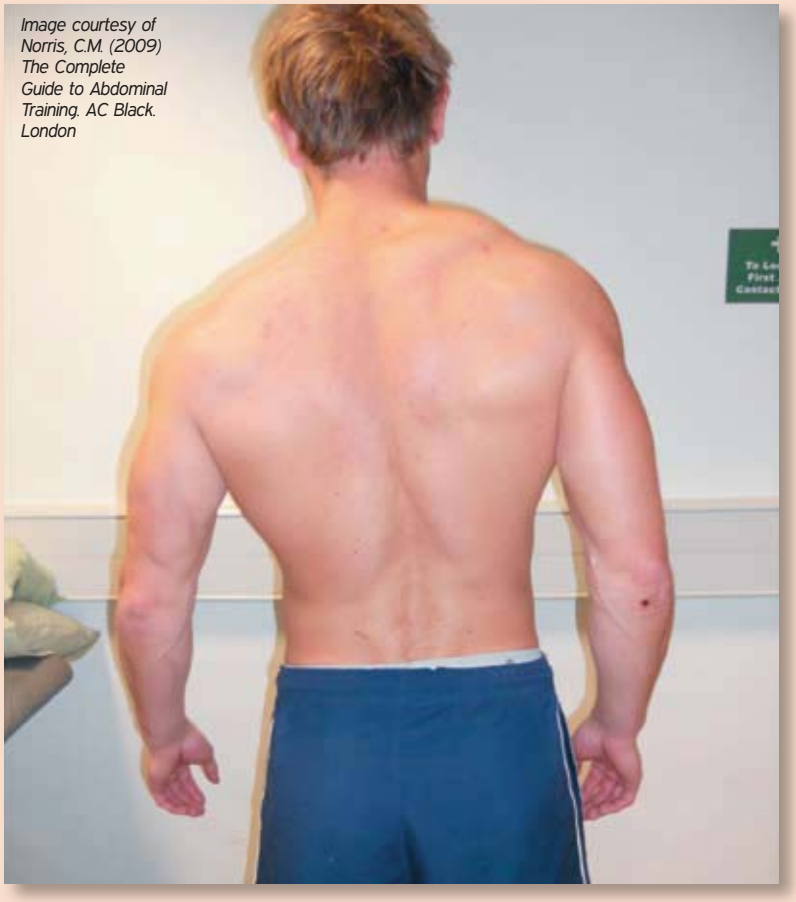
kneecaps facing in the same direction. Look for symmetry of muscle bulk. It is common for one calf to be larger than the other, especially following an injury, and the angulation of the patellae can suggest changes in patella position relative to the underlying femur or rotation of the leg from the hip or foot.

Asymmetry of the lumbar musculature is common. Muscle wasting following long-term pain may occur, while short-term pain may result from muscle spasm. Ask the patient to bend forwards while you squat down to view across their back muscles (skyline view) at waist level (Figure 3). The rounded contour of the spine can sometimes help you detect more subtle contour changes. Changes in rib position can also be seen in this position higher up the body in the thoracic region.

Where spinal extensor muscle asymmetry is noted, side bending is likely to be restricted away from the thicker side (left-side muscles tight, right-side bending reduced). Tightness and shortness in the soft tissues on one side of the body may also pull the spine away from the vertical position, altering the position of the shoulders relative to the pelvis. If this change is very subtle, it may be difficult to detect, but noting the gap between the arm and the side of the body (called the keyhole) can make things easier. If the trunk is pulled to the left, the right arm will fall closer to the body (narrower keyhole), while the left falls further away (wider keyhole) (Figure 4). Tightness that extends into the quadratus lumborum muscles will also anchor the lower ribs down, reducing the gap between the pelvic rim and lower ribs.

> "POSTURAL CHANGES CAN INCREASE OR REDUCE THE DEPTH OF THE LUMBAR CURVE, CHANGING DISC PRESSURE AND FACET JOINT LOADING WITHIN THE LUMBAR SPINE"

Figure 4: Lateral asymmetry shows as unequal distance between arm and trunk (keyhole)



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Again, compare one side with the other: the thicker and shorter muscle is normally on the side of reduced space.

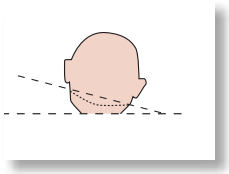
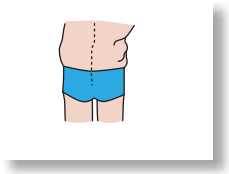
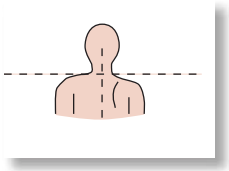
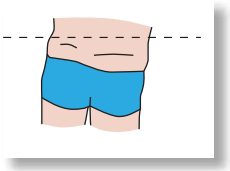
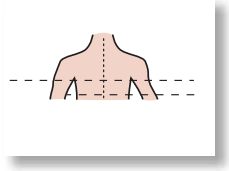
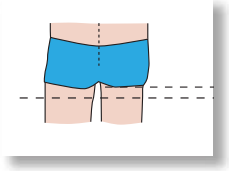
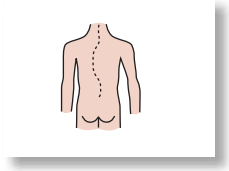
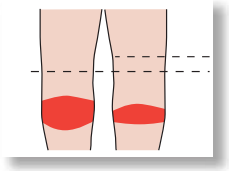
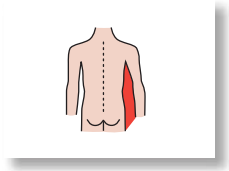
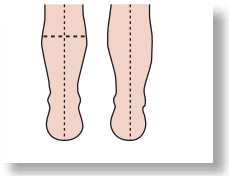
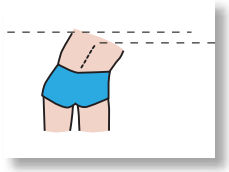
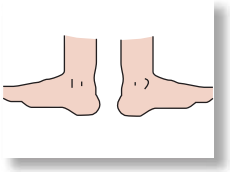
Moving up to the thoracic region, each scapula should lie approximately one hand's width from the spine. A closer position can indicate shortening in the rhomboid muscles, while a position further away normally indicates tightness in the pectoral muscles of the chest and laxity of the shoulder retractor muscles. The contour of the shoulder shows the relative condition of the upper trapezius, with a rigid cord-like contour indicating an overly tight, thickened muscle. A line drawn between the acromion processes of each side should be horizontal. Tightness of the trapezius and sternocleidomastoid muscles can cause the shoulder to raise, while laxity of these muscles and poor scapular stability can cause the scapula and clavicle to drop, a common feature in thoracic outlet syndrome, a condition giving neurological pain referred from the shoulder into the arm.

USING THE POSTURE CHARTS

The posture charts (Figure 5) help you to record the patient's static posture from the side (sagittal plane) and behind (frontal plane). For each body segment the line figure reminds you of what to look for. You can score the patient's posture as 3 (good to optimal), 2 (intermediate to slightly suboptimal) or 1 (poor to gross changes). Although subjective, the numbering system gives the patient a "posture value", with a maximum value of 48 and a minimum of 16; this can be converted to a percentage by dividing the value by 48 and then multiplying by 100.

For example, a patient who scores a total of 24 has a posture value of 50% (24/48 · 100), while a patient scoring 35 has a value of 73% (35/48 · 100). The posture value can then be used to track progress of therapy to optimise the patient's posture.

ASSESSING STANDING POSTURE FROM BEHIND

PART OF THE BODY	CHANGES	PART OF THE BODY	CHANGES
Ear level/hair line		Skin creases	
			
Shoulder level/cervical spine		Level of pelvic rim, ASIS, belt line	
			
Inferior level of scapular		Buttock creases	
			
Overall spinal alignment		Knee creases/muscle bulk	
			
Keyhole		Mid line/achilles angle	
			
Adam's position		Foot position	
			

Images courtesy of Norris, C.M. (2009) The Complete Guide to Abdominal Training. AC Black.

Figure 5: Assessing standing posture from behind form

online

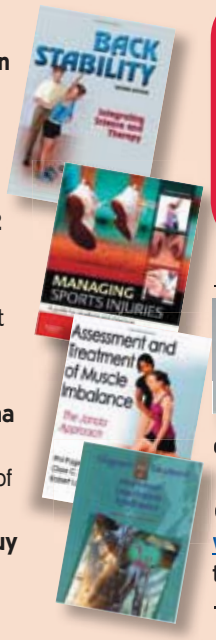
Click to view the videos

Video 1: Postural assessment

Video 2: Common postural abnormalities

FURTHER INFORMTION

- Norris CM. Back stability, 2nd edn. **Human Kinetics 2008. ISBN 9780736070171 (£32.29). Buy from Amazon http://bit.ly/ijGyNN**
- Norris CM. Managing sports injuries, 4th edn. **Elsevier 2011. ISBN 9780702034732 (£47.49). Buy from Amazon http://bit.ly/g70031**
- Page P, Frank CC, Lardner R. Assessment and treatment of muscle imbalance: the Janda approach. **Human Kinetics 2010. ISBN 9780736074001 (£37.83). Buy froma Amazon http://bit.ly/fQyBsE**
- Sahrmann SA. Diagnosis and treatment of movement impairment syndromes. **Mosby 2002. ISBN 9780801672057 (£38.74). Buy from Amazon http://bit.ly/dUiGHA**



TEST YOUR LEARNING

- What type of loading does a joint rely on to flush nutrients from the synovial fluid into the joint cartilage?
- With respect to the posture line, where should the shoulder joint lie in an optimal posture?

THE AUTHOR

Christopher Norris is a physiotherapist specialising in musculoskeletal treatment. He is an external lecturer and external examiner to several universities and runs postgraduate continuing professional development courses (listed on his website at www.norrisassociates.co.uk). He is the author of ten therapy books (see left).