Self-treatment of mid-thoracic dysfunction: a key link in the body axis

Part 1: Overview and assessment

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Introduction

Modern societies emphasis on sitting has unequivocal effects on our upright posture. In particular, the mid-thoracic region tends to become more kyphotic. While not a direct producer of local pain due to the inherent stability of the thoracic spine and rib cage, this functional-biomechanical deficit can have secondary consequences throughout the locomotor system. In particular, head forward posture, chin protrusion, round shoulders, increased lumbo-sacral lordosis, and approximation of the sternum and symphysis are all typical changes which inevitably destabilize regional tissues and result in various painful syndromes. This article will outline the resulting dysfunctions — including muscle imbalances, which occur due to this posture. The second part will address treatment issues and the third part will summarize relevant clinical issues.

Mid-thoracic (T4–T8) dysfunction

Mid-thoracic dysfunction typically involves increased kyphosis of the thoracic spine from T4–T8. It is usually a result of prolonged sitting in a constrained posture (Fig. 1). Thoracic, lumbo-pelvic, and cervico-cranial posture are interrelated as links in a chain (Fig. 2). They influence each other in dysfunction as well as in rehabilitation. As a result of the increased thoracic kyphosis biomechanical overload and functional adaptations can occur in various sites of the

Fig. 1 Increased kyphosis from faulty sitting posture.

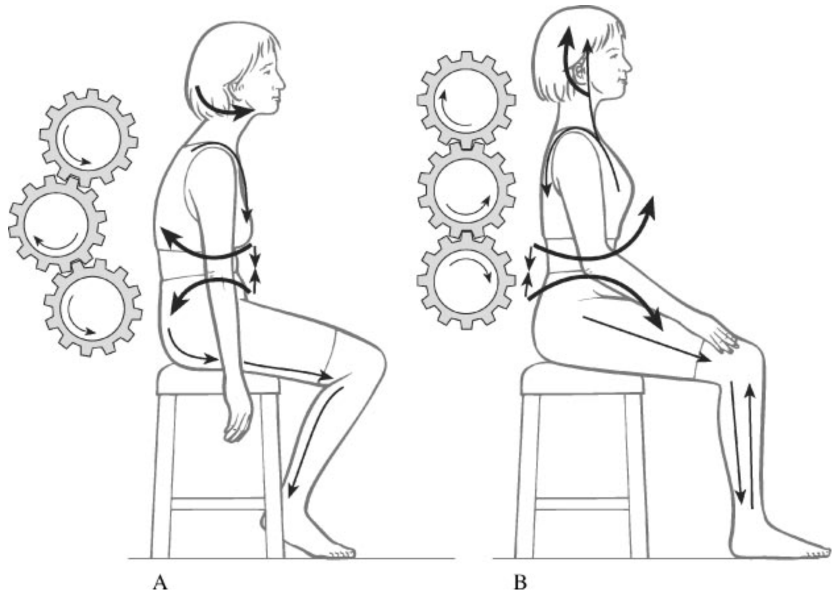

Fig. 2 Chain reactions in posture.

Table 1 Functional adaptations secondary to T4–T8 dysfunction

- Round shoulders and upper trapezius overactivity
- Head forward posture
- Chin protrusion
- Sternosymphyseal approximation
- Increased lumbar lordosis

Table 2 Relationship of functional adaptations to areas of biomechanical overload

Functional adaptation	Area of biomechanical overload
• Round shoulders and upper trapezius overactivity	• Glenohumeral joint (impingement)
• Head forward posture	• Cervico-cranial junction (hyperextension)
• Chin protrusion	• TMJ (Decreased mouth opening)
• Sternal-symphyseal approximation	• Diaphragm (faulty respiration)
• Inceased lumbar lordosis	• T/L erector spinae (hypertrophy)

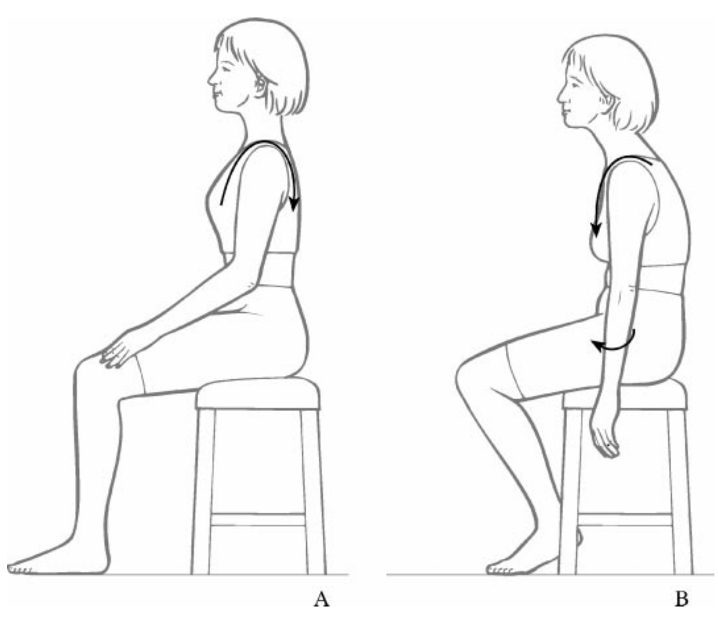

Fig. 3 Shoulder forward posture; (A) normal, (B) faulty.

locomotor system. Brügger's sternosymphyseal syndrome is an apt description of the collection of pain syndromes, functional limitations, and performance deficits which can all result from this endemic postural disorder (Lewit 1996, 1999; Liebenson et al. 1998; Liebenson 1999). In the kyphotic posture the sternum and symphysis pubis approximate affecting not just the joints already mentioned but key muscles such as the diaphragm in basic functions such as respiration. Tables 1 and 2 summarize some of the more clinically relevant examples of functional adaptation and biomechanical overload secondary to mid-thoracic dysfunction.

Increased mid-thoracic kyphosis pitches the shoulders forward into a rounded and internally rotated position (Fig. 3) (Janda 1996, 1998; Liebenson et al. 1998). With the shoulders rolled forward the pectorals habituate to a shortened length as do the internal rotators including subscapularis, pectorals, and latissmus dorsi. This increases stress on the glenohumeral (GH) joint anteriorly and superiorly by altering the scapulohumeral rhythm, reducing mobility in arm elevation and predisposing to mechanical impingement of the subacromial space, anterior labrum instability, and rotator cuff tendinosis (Wilk & Arrigo 1992; Kamkar et al. 1993; Grant et al. 1997; Norris 1998; Liebenson et al. 1998). With the shoulders forward the upper

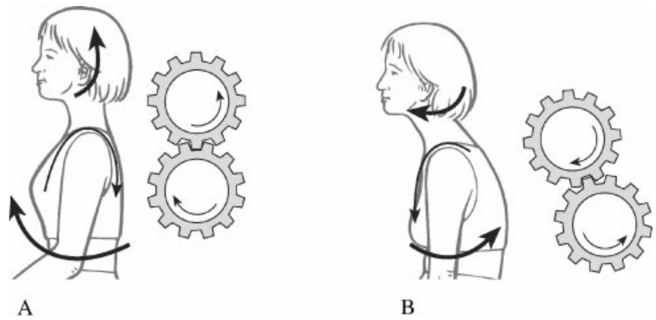

Fig. 4 Head forward posture; (A) normal, (B) faulty.

trapezius functionally adapts by tensing in order to check-rein both the forward shoulders and head. Often this upper trapezius tension is mistakenly treated as a primary problem when it is usually secondary to the other biomechanical factors which are 'upstream' of it.

The head forward posture goes hand in hand with increased thoracic kyphosis (Fig. 4) (Janda 1986, 1996, 1998; Murphy 1999; Lewit 1996, 1999; Liebenson 1996; Liebenson et al. 1998; Skaggs & Liebenson 2000). Usually the lower cervical spine loses its normal lordosis and the cervico-cranial junction (C0-C1) secondarily compensates by hyperextending in an attempt to keep the visual gaze in the horizontal plane (Watson, Trott 1993; Murphy 1999; Janda 1986; Liebenson et al. 1998). Often treatment is mistakenly focused on the compensatory C0-C1 hyperextension rather than the source of this functional adaptation.

Chin protrusion normally follows from head forward posture and will alter function of the temperomandibular joint (TMJ) (Janda 1986; Skaggs & Liebenson 2000). Specifically when a protruded chin is present the patient has decreased extensibility in mouth opening which alters the biomechanics of the TMJ increasing stress on the disc (Skaggs & Liebenson 2000).

Faulty respiration secondary to the sternosymphyseal syndrome occurs due to lower rib compression on the diaphragm (Lewit 1999; Liebenson 1999a, 1999b). The accessory muscles of respiration such as the scalenes and shoulder girdle elevators substitute for the inhibited diaphragm and result in upper chest breathing predominating over belly breathing (Fig. 5) (Simons et al. 1999; Lewit 1980, 1999; Liebenson et al. 1998; Liebenson 1999b). In the seated position the patient breathes by vertically raising their chest rather than widening the rib cage in the horizontal plane (Lewit 1980, 1999; Liebenson et al. 1998; Liebenson 1999b).

When thoracic kyphosis is increased compensations above and below occur in an attempt to stabilize the bodies center of mass and restore equilibrium. Most of the changes above have already been described. Commonly, increased anterior pelvic tilt and shortened psoas or increased lumbar lordosis is present as a secondary compensation or functional adaptation to decreased thoracic mobility in extension (Norris 1998). Overactivity of the thoraco-lumbar (T/L) erector spinae muscles is seen as an attempt to check-rein the forward drawn posture (Fig. 6). The muscles may even become hypertrophied in chronic cases in individuals who have sedentary histories (Janda 1996; Lewit 1999; Liebenson & Chapman 1998b).

Assessment of myofascial pain and muscle imbalance associated with mid-thoracic dysfunction

Myofascial pain, muscular overload, and joint strain are clinically related. With postural change such as

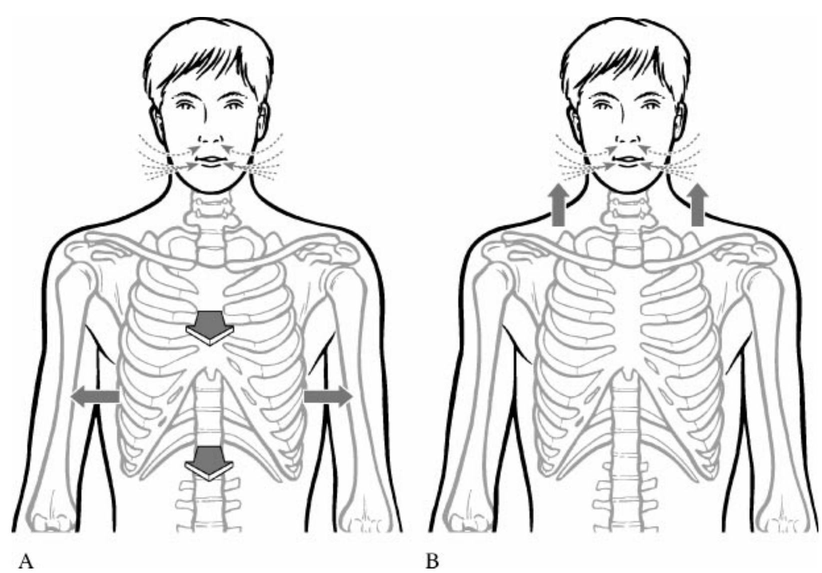

Fig. 5 Respiration-inhalation phase; (A) normal, (B) faulty.

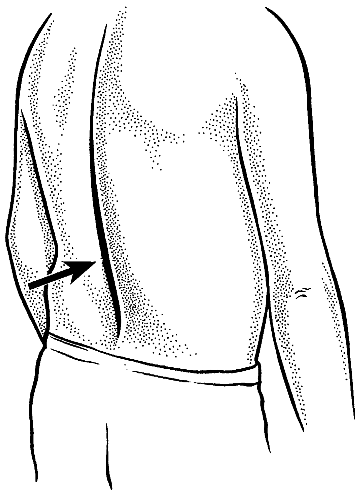

Fig. 6 Right thoracolumbar erector spinae hypertrophy.

increased thoracic kyphosis certain muscle imbalances in other regions predictably occur and are easily indentifiable. In many cases when thoracic kyphosis increases other joints such as the GH or upper cervical find themselves in new positions. The GH may be drawn forward and internally rotated while the upper cervical spine is hyperextended.

With a change in joint position agonist and antagonist muscles surrounding these joints will undergo length and tension changes. Muscles which are held in a shortened position for a long period of time may adapt to this by losing their flexibility or 'resting length' (Norris 1998, 2000). As a result, even passive positioning of the related joints back to more 'neutral' or 'centrated' positions may be hindered by resultant passive insufficiency of the shortened tissues.

When passive mobilization or positioning of a joint such as a forward drawn GH joint into a 'neutral' posture is restricted passive insufficiency is said to be present. A forward drawn shoulder will typically overload the anterior glenoid labrum and lengthening of the shortened pectorals and posterior joint capsule will be necessary in order to 'centrate' the GH joint. Then, the muscles which have been in lengthened positions or inhibited will need to be facilitated and re-educated to function in their 'inner-range' (Norris 2000; Richardson et al. 1999). This 'inner-range' is the range of muscle length where the joint is in a 'neutral' position and agonist and anagonist muscles are in balance with respect to their length. Naturally, if muscle shortening (or overactivity) and lengthening (or inhibition) are present and these changes occurred secondary to thoracic kyphosis then symptoms from the related joint — such as the GH joint (i.e. rotator cuff tendinitits, anterior instability, impingement) will eventually recur unless the source of the biomechanical overload is addressed.

Functional adaptations to the thoracic kyphosis often lead to other tissues becoming overloaded. While it is the overloaded tissues which usually generate pain it is important to realize that the source of such biomechanical overload is in other tissues functional related, but at a distance in the kinetic chain (Kibler 1998; Kibler et al. 1998; Lewit 1999, 1999b).

Key myofascial or osteoligamentous pain syndromes and muscle imbalances associated with T4–T8 dysfunction include the following (see Table 3):

- Pain referred from the sternocleidomastoid (SCM) muscle(s) or upper cervical joints is related to muscle imbalance involving shortened suboccipitals combined with overactive SCM and inhibited deep neck flexors (DNF) (Fig. 7). A simple screen is to perform the **head/neck flexion test** (Fig. 8).

Table 3 Muscle imbalances associated w/T4–T8 dysfunction

Shortened	Overactive	Inhibited
Suboccipitals	SCM	DNF
Pectorals	Upper trapezius	Lower trapezius
	Scalenes & Upper trapezius	Diaphragm
Masseters and Lateral Pterygoids		Digastricus

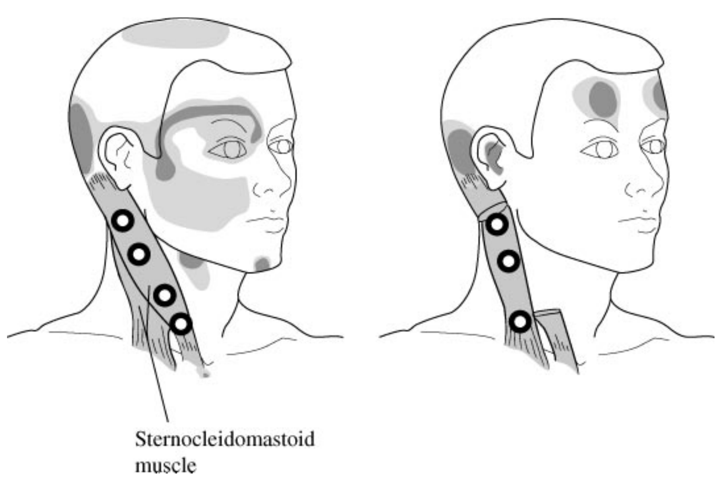

Fig. 7 SCM trigger points. Reprinted from Clinical Application of Neuromuscular Techniques, Volume 1, Chaitow, by permission of the publisher Churchill Livingstone.

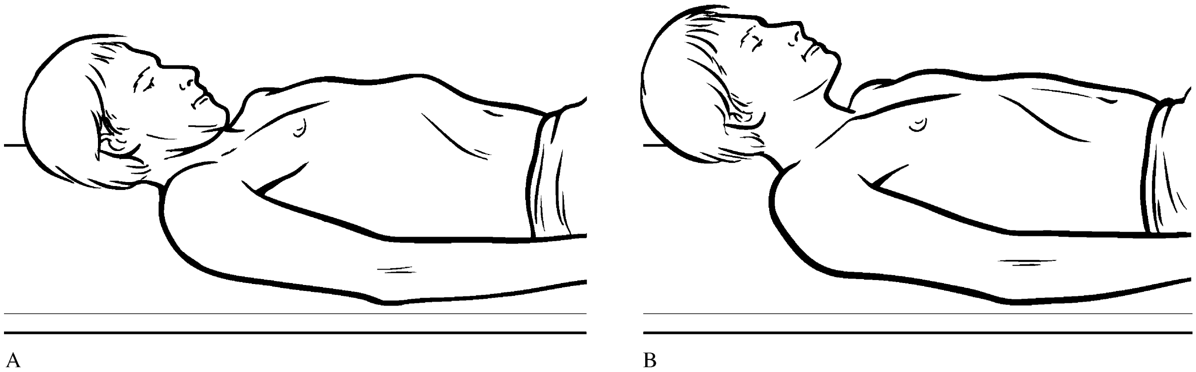

Fig. 8 Head/neck flexion coordination test (after Janda); (A) normal, (B) faulty. Reprinted from Muscle Energy Techniques, Chaitow, by permission of the publisher Churchill Livingstone.

- Pain referred from upper trapezius or pectoral muscles or GH joint is related to muscle imbalance involving shortened pectorals combined with overactive upper trapezius and inhibited lower trapezius and dorsal erector spinae (Fig. 9A & B). A simple screen is to perform the **arm abduction test** (Fig. 10).
- Pain referred from scalenes or upper trapezius muscles or upper ribs is related to muscle imbalance involving overactive scalenes and upper trapezius combined with inhibition of the diaphragm (Fig. 11). A simple screen is to perform **an evaluation of respiration during inhalation** (Fig. 5).

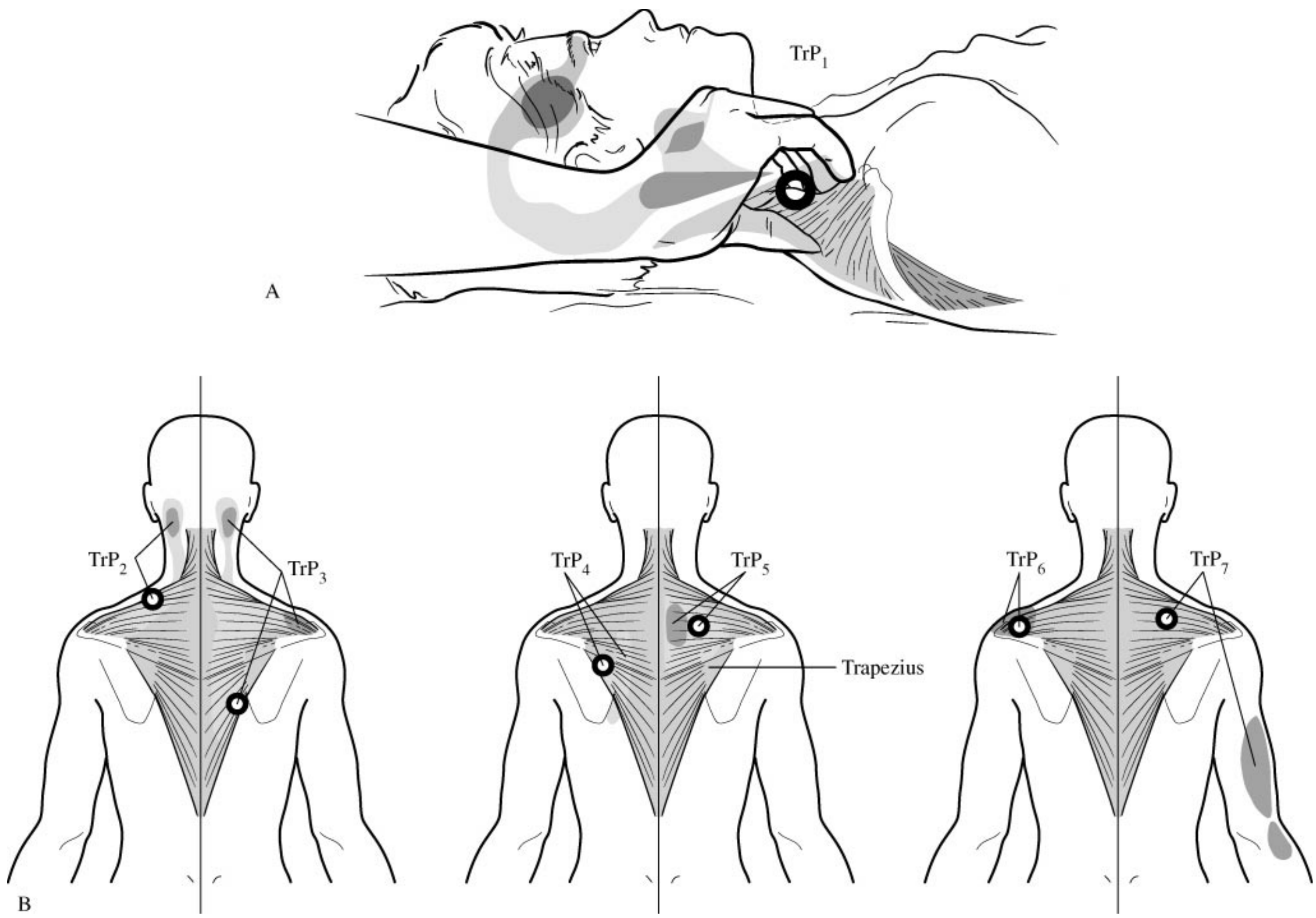

Fig. 9 Upper trapezius trigger points. Reprinted from Clinical Application of Neuromuscular Techniques, Volume 1, Chaitow, by permission of the publisher Churchill Livingstone.

- Pain referred from the masseter or lateral pterygoid muscles or the TMJ is related to shortened masseters and lateral pterygoids combined with inhibition of the digastricus (Fig. 12A & B). A simple screen is to perform the **mouth opening test** (Fig. 13).
- Pain referred from the T/L erector spinae muscle(s) or T10-L5 joints is related to overactivity of the T/L erector spinae combined with inhibition of the dorsal erector spinae (Fig. 14). A simple screen is to perform the **standing arm elevation test** (Fig. 15).

A simple functional test for evaluating mid-thoracic extension mobility is **the standing arm elevation test** (Fig. 15). To perform this test follow these steps:

- Patient stands with their buttocks and spine against a wall
- Feet are slightly forward (about 2 inches)
- Patient is instructed to raise arms directly in front and then all the way overhead

The test is + if:

- Lumbar lordosis ↑'es
- Arms don't reach the wall.

Summary

An examination of mid-dorsal kyphosis and related dysfunctions should be considered a routine part of the work-up for many pain syndromes. Such an evaluation can be customized based on the patient's presenting complaint and history. Mid-dorsal kyhphosis can be either a key perpetuating factor or underlying cause of pain generators such as the TMJ, shoulder, cervical spine or even low back. Part two of this series will discuss treatment of mid-thoracic dysfunction including patient advice, manipulation and exercise.

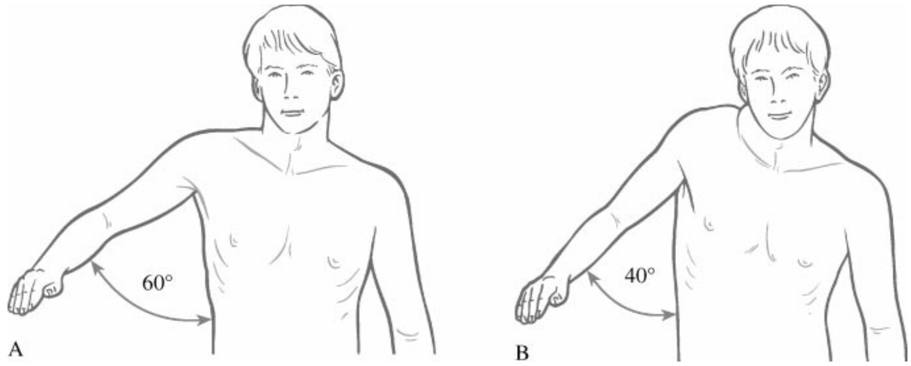

Fig. 10 Arm abduction coordination test (after Janda); (A) normal, (B) faulty. Reprinted from Muscle Energy Techniques, Chaitow, by permission of the publisher Churchill Livingstone.

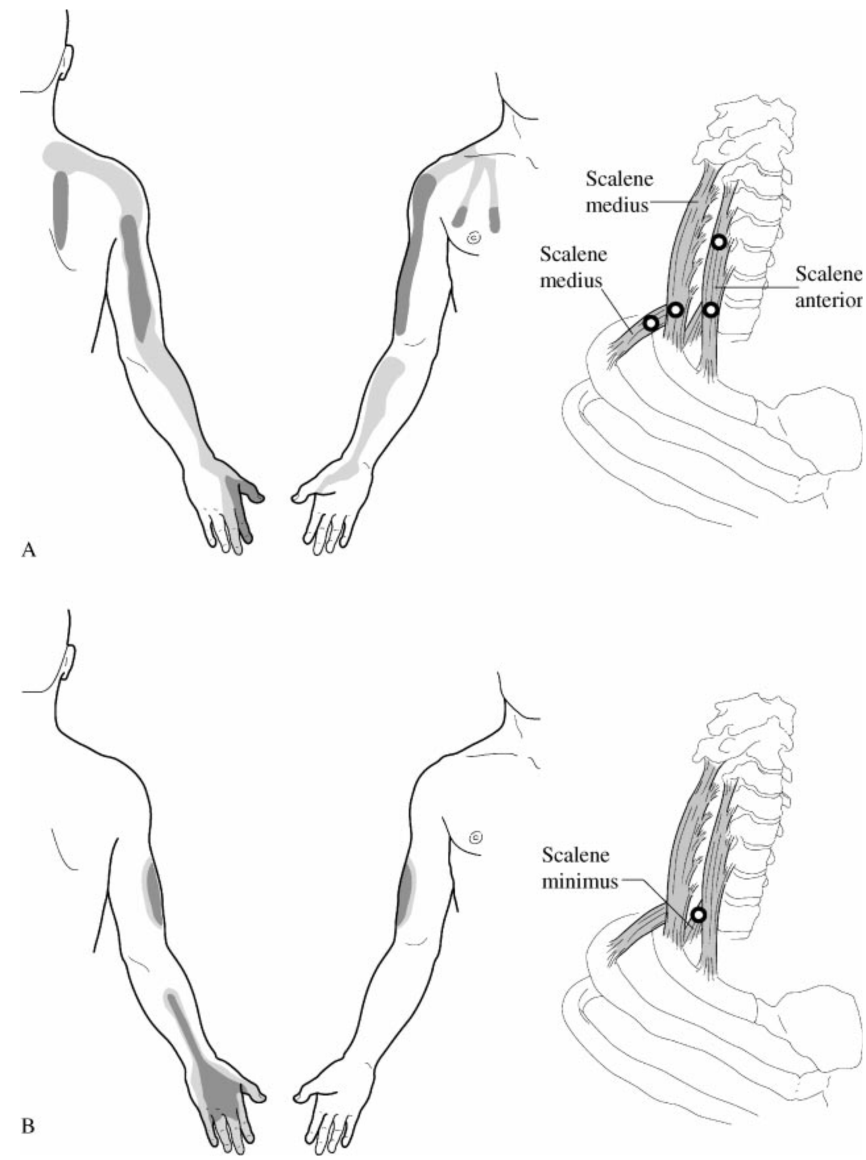

Fig. 11 Scalenes trigger points. Reprinted from Clinical Application of Neuromuscular Techniques, Volume 1, Chaitow, by permission of the publisher Churchill Livingstone.

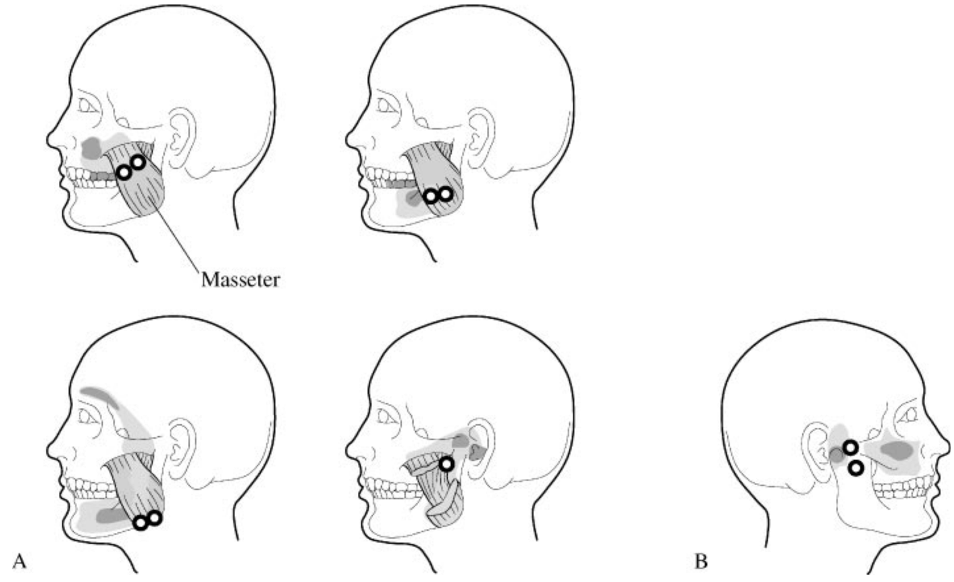

Fig. 12 (A) Masseter trigger points. (B) Lateral pterygoid trigger points. Reprinted from Clinical Application of Neuromuscular Techniques, Volume 1, Chaitow, by permission of the publisher Churchill Livingstone.

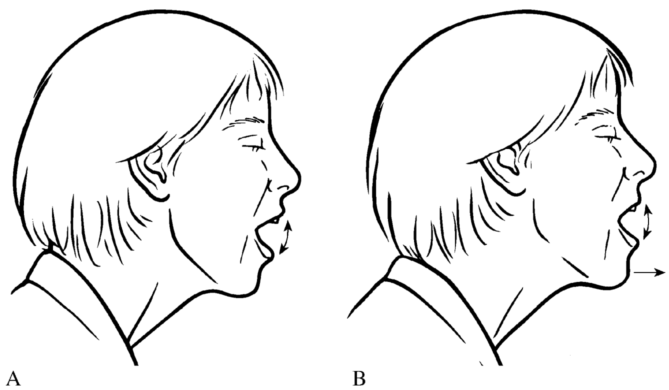

Fig. 13 Mouth opening coordination test (after Skaggs); (A) normal, (B) faulty.

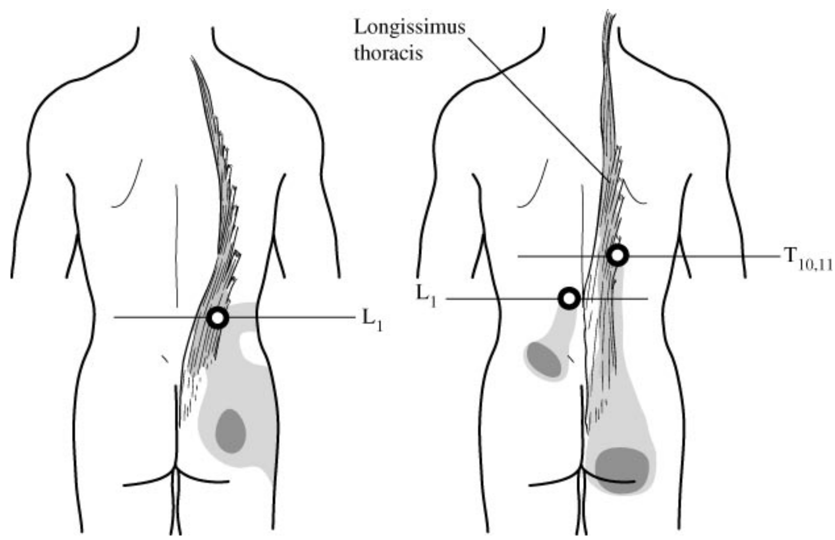

Fig. 14 Thoraco-lumbar erector spinae trigger points. Reprinted from Clinical Application of Neuromuscular Techniques, Volume 1, Chaitow, by permission of the publisher Churchill Livingstone.

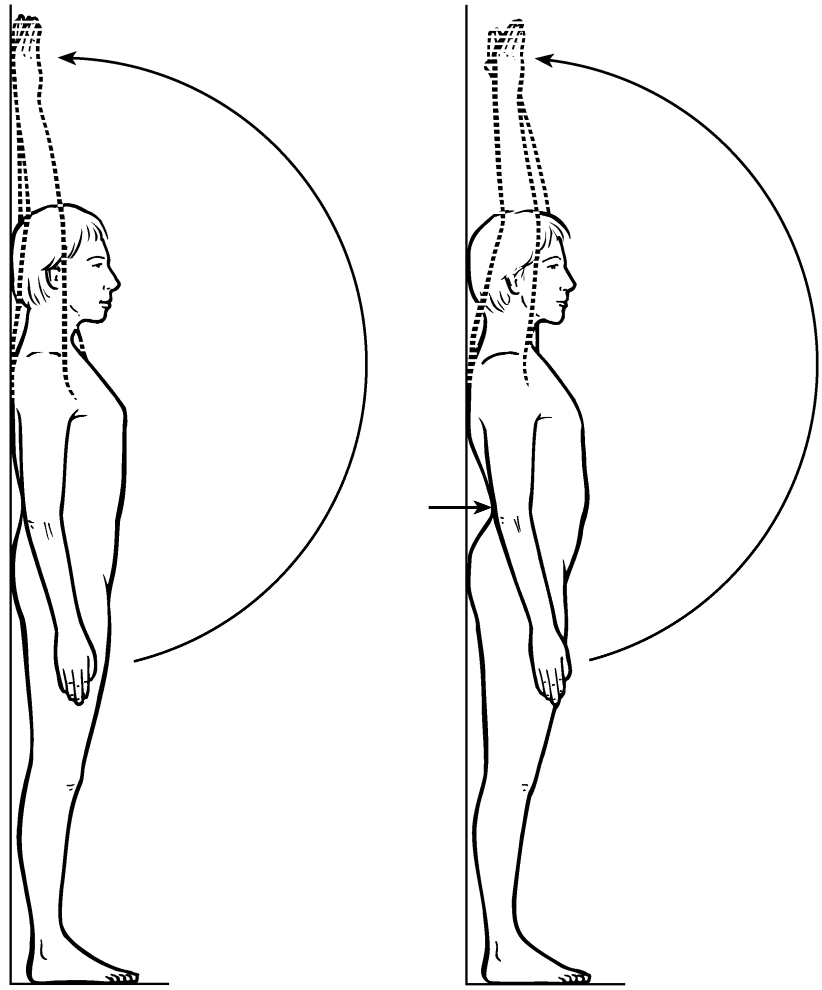

Fig. 15 Standing arm elevation coordination test (after Norris); (A) correct, (B) faulty.

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