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Articular dysfunction patterns in patients with mechanical low back pain: A clinical algorithm to guide specific mobilization and manipulation techniques

V. Dewitte, B. Cagnie*, T. Barbe, A. Beernaert, B. Vanthillo, L. Danneels

Ghent University, Department of Rehabilitation Sciences and Physiotherapy, De Pintelaan 185 3B3, 9000 Ghent, Belgium

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ABSTRACT

Recent systematic reviews have demonstrated reasonable evidence that lumbar mobilization and manipulation techniques are beneficial. However, knowledge on optimal techniques and doses, and its clinical reasoning is currently lacking. To address this, a clinical algorithm is presented so as to guide therapists in their clinical reasoning to identify patients who are likely to respond to lumbar mobilization and/or manipulation and to direct appropriate technique selection. Key features in subjective and clinical examination suggestive of mechanical nociceptive pain probably arising from articular structures, can categorize patients into distinct articular dysfunction patterns. Based on these patterns, specific mobilization and manipulation techniques are suggested. This clinical algorithm is merely based on empirical clinical expertise and complemented through knowledge exchange between international colleagues. The added value of the proposed articular dysfunction patterns should be considered within a broader perspective.

1. Introduction

Zygapophysial joints are shown to be a potential source of low back pain (LBP) (Borenstein, 2004). In order to suggest a facet joint as an underlying cause of the patient's LBP, a thorough investigation is warranted. Forming a diagnosis based on a combination of findings is typical of the reasoning approach used by clinicians (Hancock et al., 2007). Although several clinical tests have been used for many years, no persuasive scientific evidence is currently available to underline the discriminative value of such tests. Hence current recommendations state that it is impossible to identify a source for a patient's LBP (Hancock et al., 2007).

In a quest to point out simple causal structures for LBP, clinicians seek the most appropriate diagnostic tools that render a straightforward diagnosis. Numerous studies have attempted to delineate a discrete set of subjective and physical findings suggestive of lumbar facet arthropathy (Fairbank et al., 1981; Helbig and Lee, 1988; Jackson et al., 1988; Schwarzer et al., 1994; Revel et al., 1998), but several reviews have concluded that an analgesic response to image-guided intra-articular or medial branch blocks is the only reliable and valid method to identify a facet joint(s) as the primary pain generator (Dreyer and Dreyfuss, 1996; Sowa, 2005; Cohen and Raja, 2007).

However, interventional techniques do not seem suitable for routine clinical use, since they are invasive, expensive and not widely available (Hancock et al., 2007). Consequently, the absence of a universally accepted gold standard to diagnose facet joint origin challenges the clinician to recognize patterns and link them to treatment techniques. Similar to a recent published Masterclass on cervical dysfunction patterns (Dewitte et al., 2014), this issue presents a clinical algorithm for guiding therapists in their clinical reasoning to identify patients with predominantly mechanical nociceptive pain probably arising from articular structures, who are likely to respond to mobilization and/or manipulation.

2. Clinical subgroups

The presented reasoning process is situated within the context of pain mechanisms and is narrowed to and applicable in patients with a dominant input pain mechanism with mechanical nociceptive pain probably arising from articular structures. The reader is referred to several more thorough accounts where the reference framework is delineated in more detail (Danneels et al., 2011; Dewitte et al., 2014). Even though minor symptoms coming from

* Corresponding author. Tel.: +32 9 332 52 65.
E-mail address: barbara.cagnie@ugent.be (B. Cagnie).

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muscular or neurological structures might be present in patients suffering from mechanical LBP, the dominant pain source should be articular to justify the use of specific mobilizations and/or manipulations.

Standardized subjective and physical assessment is imperative to obtain a proper differential diagnosis and is essential to identify articular dysfunction patterns. "Convergence" and "divergence" are the two common articular dysfunction patterns. During convergence the intra-articular pressure of the zygapophysial joints is believed to increase whereas during divergence the pressure is supposed to decrease. Table 1 outlines important clinical features of both patterns.

Based on clinical experience 3 key points will determine the type of articular dysfunction pattern:

1) *Provocation of symptoms during passive combined movement testing*: Specific combinations of combined movements can reproduce the patient's symptoms. The components of the combined movement during which the patient's symptoms are provoked, will determine the type of articular dysfunction pattern. The primary components are extension and flexion respectively combined with side bending whereas rotation is the additional component to make the symptoms more provocative. Reduced range of movement (ROM) is also often detected.
2) *Type of mechanical pain*: This may be categorized as compression pain originating from intra-articular derangements or stretch pain originating from capsulo-ligamentous structures.
3) *Restricted intervertebral movement tests*: Intervertebral movement tests may give additional information on the quality and quantity of the segmental joint play, as reduced intervertebral movement is very often associated with both articular dysfunction patterns.

2.1. Convergence pattern

The monosegmental convergence pattern is characterized by pain provocation and movement loss during the combination of ipsilateral side bending and extension at the start, mid or end ROM. Those combined movements are associated with ipsilateral compression pain, which can be more provocative by adding contralateral rotation. In some cases contralateral side bending can give a feeling of painful strain at the end ROM.

During the intervertebral movement tests, ipsilateral side bending and contralateral rotation are usually restricted. In addition, increased ipsilateral muscle tone may be felt by palpating the muscles transversely. In acute cases, the convergence pattern can be associated with severe movement loss, defensive muscle guarding and antalgic posture.

Table 1
Features of mono-segmental lumbar spine articular patterns.

	Lumbar spine	
	Convergence pattern	Divergence pattern
Subjective examination		
feeling of locking	yes	no
movement restriction	yes	yes at end of ROM
painful strain	sometimes (contralateral)	yes (ipsilateral)
compression pain	yes (ipsilateral)	no
antalgic posture	in acute cases	uncommon
Physical examination		
Active and passive combined movement tests	limited and evoke comparable signs	limited and evoke comparable signs
Primary component	extension	flexion
side bending	ipsilateral	contralateral
rotation	contralateral	ipsilateral
Articular examination		
Provocation (spring) tests	positive at the impaired segments	positive at the impaired segments
Intervertebral movement tests		
side bending reduced	ipsilateral	contralateral
rotation reduced	contralateral	ipsilateral

2.2. Divergence pattern

The monosegmental divergence pattern is characterized by pain provocation and movement loss during combined contralateral side bending and flexion at the end ROM. These combined movements are associated with stretch pain and by adding ipsilateral rotation the patient's symptoms can be more provocative. Differential diagnosis should consider muscular strain. Intervertebral movement tests often demonstrate reduced contralateral side bending and ipsilateral rotation. An acute divergence pattern is rarely present.

3. Mobilization and manipulative techniques

Various mobilization and manipulative techniques can be distinguished for the lumbar spine. As most manual therapists use the manipulative approach as a progression of localized mobilization techniques, the techniques will only be described in terms of manipulations, bearing in mind that these can also be applied as mobilization techniques (Dewitte et al., 2014).

Both focus and locking techniques are frequently used with different strategies to enhance safety and limit ROM during the thrust phase (Dewitte et al., 2014). Locking techniques will often be the first choice in cases with relative contra-indications on a segment caudal or cranial of the affected level.

Lumbar manipulations can be used with different combined components in accordance with the progression of the healing process. This combination varies between a convergence pattern and a divergence pattern.

For locking techniques the traditional Lovett–Fryette rules for combined movements in the lumbar spine are still applied (Gibbons and Tehan, 1998; 2001). The authors are fully aware that there is little or no scientific agreement about these rules for the lumbar spine compared to the cervical spine (Cook et al., 2006; Legaspi and Edmond, 2007). Therefore, therapists should bear in mind that motion coupling behavior may vary amongst individuals and they should rely on findings from clinical assessment (e.g. intervertebral movement tests). Factors that can influence coupling are gender, age, first initialized movement and pathology. Also, inter-individual anatomical differences are frequently described as well as differences depending on the segmental level (Legaspi and Edmond, 2007). Nevertheless, the authors feel that the therapist can still use these rules as a guidance in the reasoning process until more scientific data are available.

3.1. Distraction techniques

In a distraction technique the available components can be altered depending on the severity of the condition and the kind of pattern. The direction of the thrust is axial in all of these techniques. With the patient in side-lying, the cranial joint partner is stabilized by the therapist. Contacting the spinous processes, the thrust is applied in a caudal direction.

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3.2. Rotation techniques

Techniques with rotation as a primary movement create a cavitation at the ipsilateral side. The targeted segment is positioned in side bending, flexion or extension and rotation. The therapist's upper body acts as a stabilizer (adding compression), with the thrust being delivered by the caudal arm. Contact points are the spinous processes. The direction of thrust is down towards the couch with a simultaneous pelvic rotation towards the operator with the patient in side-lying position.

Rotation techniques can also be applied using locking principles. In these techniques the adjacent spinal segments caudal or cranial to the affected segment should be placed in a non-physiological position to constrain their movement, whereas the affected segment is placed in a physiological position so it is more effectively targeted (Kaltenborn et al., 1993).

3.3. Side bending technique

Side bending as a main movement can also be used in lumbar manipulations. The directed segment is positioned in flexion or extension, side bending and ipsilateral rotation with the therapist's upper body and cranial arm stabilizing the cranial segment. The contact point on the caudal spinous process directs the thrust towards the couch, predominantly with the caudal hand.

4. Therapeutic guidelines for lumbar manipulative techniques

In the following paragraph, frequently used lumbar mobilization and manipulative techniques will be linked to the aforementioned articular dysfunction patterns. This is summarized in a clinical algorithm, which is presented in Fig. 1.

4.1. Convergence pattern

The main goal in the first phase (phase Ia and Ib) is to inhibit compression pain by producing cavitation at the affected joint using distraction or rotation techniques. The major components in this phase are: flexion or neutral, ipsilateral rotation and contralateral side bending. The primary goal in these techniques is to obtain pain relief (neurophysiological effect) as the effect on mobility is non-specific (Bialosky et al., 2009; 2012; Evans, 2010).

Often it is necessary to restore the remaining function deficits in a second phase (phase IIa). The use of a side bending technique in the restricted direction to restore mobility at the affected side is appropriate. An added benefit in this approach is restoring mobility without creating excessive compressional force on the affected zygapophysial joint due to the components of ipsilateral rotation and flexion while performing this technique. Occasionally, a rotation technique in the restricted direction can also be chosen to restore mobility (phase IIb) but this will create more compression at the affected side in comparison with the side bending technique.

4.2. Divergence pattern

For a lumbar articular divergence pattern the main goal is to restore function without producing excessive cavitation at the joint.

In a first phase (phase I) the goal is mainly pain relief. To avoid any strain a rotation technique can be used to the non-restricted side and away from the pain. A distraction manipulation might be

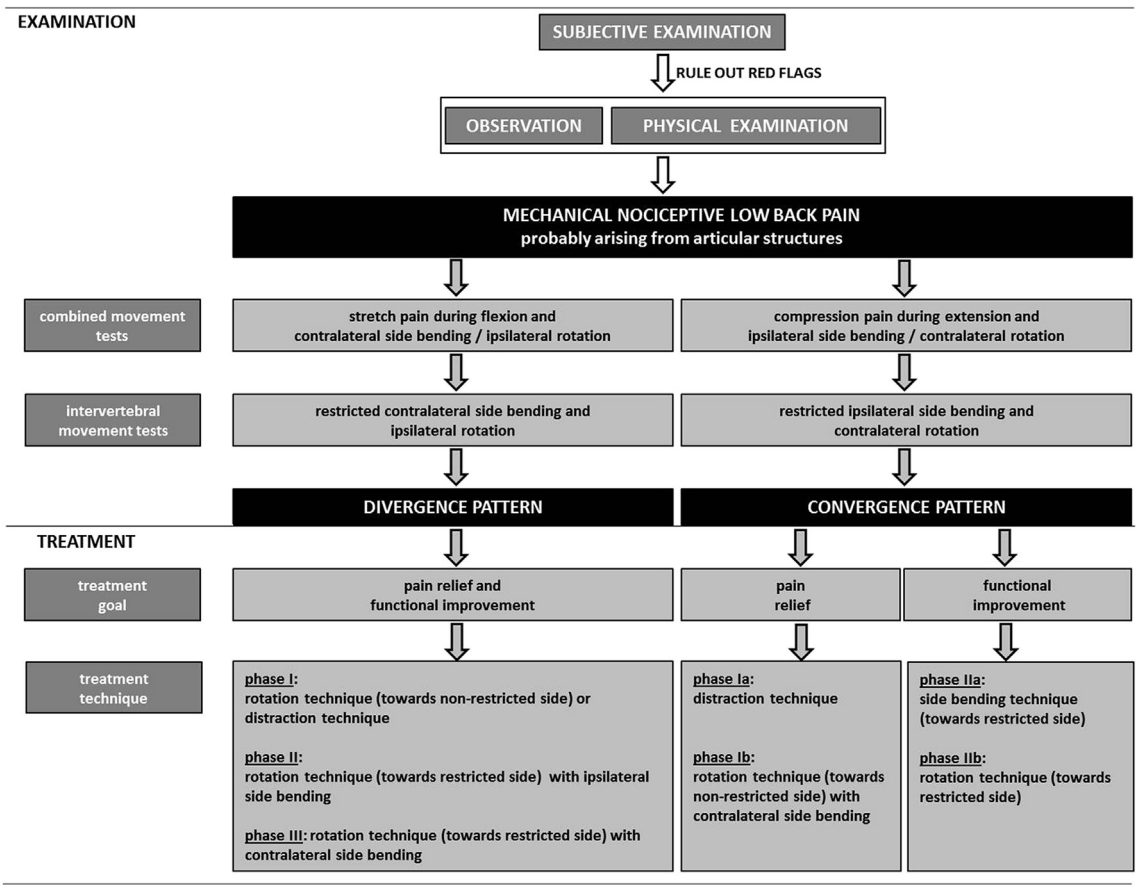

Fig. 1. Clinical algorithm.

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another possibility in this phase, since this will not create an end range distension of the zygapophysial capsule.

In the second phase (phase II) the goal is equally pain relief and restoring function. The authors suggest the use of a rotation manipulation to the restricted side combined with ipsilateral side bending in neutral (or extension) position to avoid excessive strain.

In the third phase (phase III) the goal is mainly to restore mobility. A rotation manipulation in the restricted direction (ipsilateral rotation), combined with contralateral side bending in neutral or extension position might be a good progression.

Make note that in the successive phases of both articular dysfunction patterns the side bending component is playing an important part with regard to the choice of direction related to movement restriction and pain. In the first phase(s) the side bending component is opposite to the movement restriction, whereas in the second phase the side bending is in the same direction of the movement restriction.

5. Conclusion

This professional issue introduces a clinical algorithm to guide novice therapists in their clinical reasoning to identify patients with predominantly mechanical nociceptive pain probably arising from articular structures, who are likely to respond to mobilization and/or manipulation, and to suggest hands-on treatment techniques. Although distinct techniques were initially developed to target specific structures, the clinical reasoning framework in which these techniques are applied today has drastically evolved. Based on clinical experience and international knowledge exchange the authors developed a structured reasoning framework, where distinct clinical patterns guide proper technique choice. This largely empirical approach helps therapists to detect LBP patients amenable to the proposed treatment. However, the authors do emphasize that the added value of the proposed articular dysfunction patterns can only be fully appreciated when this is considered within a broader perspective. Should the treatment response not fulfill the expectations, further investigation and additional treatment are warranted.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.math.2014.11.006.

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