One of my areas of interest is the decision making process that therapist use in deciding what manual therapy techniques to use in the treatment of hypomobile joints. In my discussions with students and other therapists, it is common for Kaltenborn’s convex-concave rule to be brought up as a means of determining the direction a joint mobilization technique is applied in the extremities. It appears that this is reflective of the thought process of the wider therapeutic community, with Kirby et al’s (2007) survey of 660 physiotherapists finding that this theory is rated as important or very important during treatment decision making by a majority of the surveys participants. Based on concepts from work involving mechanical models, the convex-concave rule proposes that the convex joint surface glides in the opposite direction to the movement of the bone (Kaltenborn & Evjenth 1989). In the glenohumeral joint this would suggest that lateral rotation is accompanied by anterior translation of the convex humeral head and that abduction is accompanied by inferior translation of the humeral head. This essay aims to explore whether this theory is supported within the literature for glenohumeral movements and reflects upon its weighting in the clinical reasoning process.

Over the last 3 decades a body of research has built up looking at translatory movement of the humeral head using various methodologies including radiography, electromagnetic tracking devices, MRI and CT scans. Likewise, a variety of subjects have been studied from cadavers, joint reconstructions models, healthy subjects and subjects with shoulder pathologies. Such studies demonstrate that the amount of translatory movement is affected by whether the movement is performed actively or passively, with the greatest amount of humeral head translation occurring as the joint reaches end range positions (Paletta et al 1997, Kardina et al 1997, Williams et al 2001). In contrast to the convex-concave rule a number of studies demonstrate that end range lateral rotation is accompanied by posterior translation of the humeral head and that the humeral head remains centered without gliding inferiorly during end range abduction (Poppen & Walker 1976, Howell et al 1988, Harryman et al 1990, Paletta et al 1997, Kardona et al 1997, Baeyen et al 2001). To explain this finding Harryman et al (1990) suggested that tension in the capsulo-ligamentous structures is the primary mechanism responsible for the direction of humeral head translation. For example, in end range lateral rotation with the arm in an over head position it is proposed that tension in the anterior-inferior glenohumeral ligaments is responsible for the posterior translation observed. This theory is further supported by the loss of posterior translation seen in patients with anterior instability, the increase in anterior translation observed with tightening of the posterior structures in cadavers and the increased subacromial contact observed in shoulder joint replacement research in which the prosthesis are malpositioned inferiorly (Howell et al 1988, Harryman et al 1990, Williams et al 2001)

In recent years advocates for the convex-concave rule have attempted to defend the theory by further clarifying the biomechanical principles on which it is based and argue that there is a difference between humeral head translation and the overall movement of 2 joint surfaces (Schomacher 2009). However, the explanation given does not appear to be backed by any substantial supporting evidence and it is unclear how the information provides any validity to the theory. In a recent systematic review on the convex-concave rule, Brandt et al (2007) reported that the studies meeting the inclusion criteria suffered from poor methodological quality, heterogeneity and inconsistent findings. Based on these factors it was suggested that no clear conclusions could be drawn regarding the direction of translation of the humeral head on the glenoid. The authors also suggest that findings drawn just from the higher quality studies
demonstrate the humeral head to stay centered during abduction, but that the direction of translation during lateral rotation was considered contradictory. However in contrast to this finding, I would suggest that one of the studies demonstrated posterior gliding of the humeral head, while the other study presented only the amount of translation without specifically commentating on the direction of translation (Karduna et al 1997, Williams et al 2001). Both studies suggest that tensioning of the capsulo-ligamentous structures is responsible for translation of the head of humerus. Further criticism of the Brandt et al’s (2007) review can also be leveled at the use of a methodological scoring system that was designed to be used for clinical trials. It can be argued that such a scoring system is of limited value for experimental study designs, particularly ones in which cadavers were used.

While it reasonable to suggest that flaws exist with all theories used as part of the clinical decision making process, it is worth considering whether using the convex-concave rule to determine the direction to apply a joint mobilization represents best practice in the treatment of a stiff shoulder. Is it any better than assessing all of the directions in which the humeral head moves and ranking which direction appears most impaired? On a more controversial note, is it any better than randomly picking a direction in the treatment selection process? It is also worth reflecting upon whether this rule actually restricts therapists from trying potential efficacious treatment techniques. Are a number of mobilization directions not even considered because they contradict the rule? In the end regardless of the weighting you give this rule, hopefully it can be agreed that this topic serves as a useful reminder that careful reassessment and ‘proving the value’ of a technique is a worthwhile cornerstone of clinical practice.

References


