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ScienceDirect
Manual Therapy 12 (2007) 3–11
MANUAL THERAPY
www.elsevier.com/locate/math

Review

An evidence-based review on the validity of the Kaltenborn rule as applied to the glenohumeral joint

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Received 25 January 2005; received in revised form 26 January 2006; accepted 15 February 2006

Abstract

Kaltenborn's convex–concave rule is a familiar concept in joint treatment techniques and arthrokinematics. Recent investigations on the glenohumeral joint appear to question this rule and thus accepted practice guidelines. An evidence-based systematic review was conducted to summarize and interpret the evidence on the direction of the accessory gliding movement of the head of the humerus (HOH) on the glenoid during physiological shoulder movement. Five hundred and eighty-one citations were screened. Data from 30 studies were summarized in five evidence tables with good inter-extracter agreement. The quality of the clinical trials rated a mean score of 51.27% according to the Physiotherapy Evidence Database scale (inter-rater agreement: $\kappa = -0.6111$). Heterogeneity among studies precluded a quantitative meta-analysis. Weighting of the evidence according to Elwood's classification and the Agency for Health Care Policy and Research classification guidelines indicated that evidence was weak and limited. Poor methodological quality, weak evidence, heterogeneity and inconsistent findings among the reviewed studies regarding the direction of translation of the HOH on the glenoid, precluded the drawing of any firm conclusions from this review. Evidence, however, indicated that not only the passive, but also the active and control subsystems of the shoulder may need to be considered when determining the direction of the translational gliding of the HOH. The indirect method, using Kaltenborn's convex–concave rule as applied to the glenohumeral joint, may therefore need to be reconsidered.

Keywords: Glenohumeral; Translational glide; Evidence-based; Kaltenborn

Contents

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doi:10.1016/j.math.2006.02.011

1. Introduction/background

Dysfunction of the shoulder girdle is one of the most common musculoskeletal conditions to be treated in primary care. Thirty-four per cent of the general population may suffer from shoulder pain at least once in their lifetime (Green et al., 2002). In addition to the high incidence rate, shoulder dysfunction is often persistent and recurrent (Winters et al., 1999).

Physiotherapy for shoulder dysfunction may include manual therapy joint techniques to treat pain or stiffness. Various approaches to treatment have been proposed, such as the Maitland approach (Maitland, 1998), movement with mobilization (Mulligan, 1999), and the application of passive mobilization techniques following the convex–concave rule (Kaltenborn and Evjenth, 1989).

The latter approach is based on direct and indirect assessment of translational glides. Using the direct method, the passive translational gliding movements are performed by the therapist to the patient's painful and/or stiff joint to determine which direction may be limited (Kaltenborn and Evjenth, 1989). Joint mobilizations would then be performed as a treatment method in the decreased direction to restore normal movement. The indirect method of determining the direction of translational glide was termed the "Kaltenborn convex–concave rule" (Kaltenborn and Evjenth, 1989). This rule was first described by MacConaill (1953). Following this method, the therapist examines active and passive physiological movements such as flexion, extension, abduction and lateral rotation (Kaltenborn and Evjenth, 1989). The direction of the glide would then be determined by considering the geometry of the moving articular surfaces. In the glenohumeral joint, the glenoid fossa (concave surface) was considered to be stable (fixed) while the humeral head (convex surface) would be moved (mobilized) during a physiological shoulder movement. According to the convex–concave rule, the convex surface (humeral head) would glide in the opposite direction to the bone movement. Thus, during abduction of the arm, the humeral head would glide caudally. Kaltenborn and Evjenth (1989) proposed that for restricted shoulder extension and lateral rotation, the humeral head should be glided ventrally (anteriorly), and for restricted flexion and medial rotation, the humeral head should be glided dorsally (posteriorly).

Kaltenborn and Evjenth (1989) thus based the clinical reasoning of appropriate direction of translational glide mainly on the anatomy of the osseous articulating surfaces. More recently it has been suggested that other factors, such as the concept of functional stability (Panjabi, 1992), may also need to be considered in the assessment of the arthrokinematics of the glenohumeral joint (Hess, 2000). The question thus arose whether the convex–concave rule is valid in the clinical reasoning of the most appropriate direction of translational glide applied in the assessment and treatment of shoulder dysfunction.

The aim of this study was to investigate the evidence on the arthrokinematics of the glenohumeral joint supporting or negating the validity of the MacConaill and Kaltenborn rule and theory.

2. Methodology

2.1. The search strategy and data selection

An academic, computerized search was conducted. CINAHL, MEDLINE, The Cochrane Controlled trials register of randomized controlled trials, Kovsiedex, South African Studies and Sport Discussion were searched from 1966 to October 2003. The search was limited to English and human studies. Keywords such as shoulder, glenohumeral, kinematics, arthrokinematics, mechanics, translation(al), roll(-ing) and/or glide(-ing), accessory movement, and Kaltenborn were optimally combined. The search was continued over a period of ten months (Hoepfl, 2002).

The titles and the abstracts of the retrieved citations were screened for relevance by the primary investigator. The reference lists of the relevant articles were checked by one reviewer to identify additional publications. Five clinical experts in the field of shoulder orthopaedics were also contacted in order to retrieve data (Oxman et al., 1994; Mays and Pope, 1999; Green et al., 2002; Tugwell et al., 2003).

The second screening consisted of the blinded assessment of the full papers' *Method* and *Results* sections by two independent reviewers. The reports were numbered at random and the authors' names and affiliations, the name of the journal, the date of publication, and the acknowledgements were erased to ensure blinded assessment. All types of study designs were included in the systematic