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Masterclass

New concepts in restoring shoulder elevation in a stiff and painful shoulder patient

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ABSTRACT

The treatment and evaluation of a stiff and painful shoulder, characteristic of adhesive capsulitis and "frozen" shoulders, is a dilemma for orthopedic rehabilitation specialists. A stiff and painful shoulder is all-inclusive of Adhesive capsulitis and Frozen Shoulder diagnoses. Adhesive capsulitis and frozen shoulder will be referred to as a stiff and painful shoulder, throughout this paper.

Shoulder motion occurs in multiple planes of movement. Loss of shoulder mobility can result in significant functional impairment. The traditional treatment approach to restore shoulder mobility emphasizes mobilization of the shoulder overhead. Forced elevation in a stiff and painful shoulder can be painful and potentially destructive to the glenohumeral joint. This manuscript will introduce a new biomechanical approach to evaluate and treat patients with stiff and painful shoulders.

1. Introduction

Shoulder elevation is an evidently important functional movement required in activities of daily living (ADL's) and athletic activities involving reaching movements away from or across body, reaching overhead and/or throwing in sport. Activities of daily living may include but certainly not limited to dressing, bathing, overhead reaching, and don/doffing bra or clothing. Athletic activities include most sports such as swimming, baseball, football, basketball, tennis, and handball. A stiff and painful shoulder occurs when a patient loses critical motion in the shoulder and it becomes difficult and painful to move the joint in all of the planes of movement (Dudkiewicz, Oran, Salai, Palti, & Pritsch, 2004; Lubiecki & Carr, 2007).

The pain and restricted range of motion are characteristics of the adhesive capsulitis and frozen shoulder diagnoses. Adhesive capsulitis is a pathologic condition resulting from inflammation of the joint capsule and synovium followed by fibrosis, scarring and contracture of the capsuloligamentous complex. The capsuloligamentous changes result in global loss of both passive and active range of motion (ROM) of the glenohumeral joint. In most patients with a painful and stiff shoulder external rotation is the most restricted physiologic movement (Neviaser & Hannafin, 2010; Soren & Fetto, 1996; Uhthoff & Boileau, 2007). Abnormal shoulder kinematics may present with decreased scapular posterior tipping and upward rotation during arm elevation (Yang, Jan, Chang, & Lin, 2012). As the patient repetitively moves the shoulder, scarring and/or contractures typically worsen, resulting in further decrease in range of motion (Dias, Cutts, & Massoud, 2005; Earley & Shannon, 2006).

The incidence of shoulder adhesive capsulitis has been estimated to be from 3% to 6% in the general population (Blanchard, Barr, & Cerisola, 2010; Neviaser & Hannafin, 2010). It is reported in the literature that shoulder adhesive capsulitis is more frequent in women aged between 40 and 60 years (Wong & Tan, 2010) and in about 20–30% of cases this condition is bilateral (Zuckerman & Rokito, 2011). Patients suffering from shoulder adhesive capsulitis face months to years of progressive pain, stiffness and disability (Green, Buchbinder, & Hetrick, 2003; Jewell, Riddle, & Thacker, 2009).

Adhesive capsulitis is a medical diagnosis used by the International Classification of Diseases (ICD) and can be divided into two categories: primary, in which there are no obvious causes, and secondary, where a cause is identified (from history, clinical examination and radiographic appearances). Those with diabetes, prolonged shoulder immobility (trauma, overuse injuries or surgery) or systemic diseases (hyperthyroidism, hypothyroidism, cardiovascular disease or Parkinson's disease) are at a higher risk (Wong & Tan, 2010).

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Various researchers have described four stages of primary or secondary adhesive capsulitis, based on history, physical examination, and arthroscopic findings (Neviaser & Hannafin, 2010). In the first two stages, pain is characteristic of the chief complaint, and in the third and fourth stages stiffness is the predominant problem.

Stiffness is the major problem (Neviaser & Hannafin, 2010). The hallmark of stage 3 and 4 is restricted ROM or stiffness in the shoulder joint, exemplified by limited shoulder elevation activities (Neviaser & Hannafin, 2010). Unfortunately most of the patients that are referred to physical therapy with a diagnosis of adhesive capsulitis, frozen shoulder or a stiff and painful shoulder are not diagnosed as to what stage they are in.

Therefore, it is important in all stages that the clinician evaluates for impairments in the capsuloligamentous complex and musculotendinous structures surrounding the shoulder complex when the patient presents with shoulder pain and limited mobility. The loss of passive motion in multiple planes, especially external rotation in the adducted position, at 30°, 45° and 90° of abduction, are significant findings that can be used to guide the treatment plan (Kelly et al., 2013). Differential soft tissue diagnosis of a stiff and painful shoulder should be made by the clinician, after determining the soft tissues or periarticular structures that are restricting the shoulder mobility. Therefore, the stiff and painful shoulder could be from a fibrosis within the capsule, contracture of a tendon or an inflamed synovium and/or the capsuloligamentous complex.

Interventions for patients with adhesive capsulitis remain controversial and poorly understood (Bal, Eksioglu, Gulec, Aydog, Gurcay, & Cakci, 2008; Bergman et al., 2004; Buchbinder et al., 2007; Hay, Thomas, Paterson, Dziedzic, & Croft, 2003; Neviaser & Hannafin, 2010). Many studies have been reported in the orthopedic, physical therapy, and rheumatology literature in the past 40 years (Baums, Spahn, Nozaki, Steckel, Schultz, & Klinger, 2006; Carette et al., 2003; Diercks & Stevens, 2004; Neviaser & Hannafin, 2010). Treatment options documented in the literature include, physical therapy treatment, nonsteroidal anti-inflammatory medications, oral corticosteroid medications, intra-articular hydrocortisone injections, distension arthrography, closed manipulation, manipulation under anesthesia, open surgical release, and more recently, arthroscopic capsular release (Castellarin et al., 2004; Farrell, Sperling, & Cofield, 2005; Hannafin & Chiaia, 2000; Kivimäki et al., 2007). However, it is difficult to compare and apply the results clinically due to the lack of documentation as to the specificity of stage in which the adhesive capsulitis is referenced (Hay et al., 2003; Neviaser & Hannafin, 2010).

A time-honored technique in shoulder therapy is the low-load prolonged stretch and static progressive stretch (Bonutti, Hotz, Gray, Cremens, Leo, & Beyers, 1998). This technique requires placing the scarred or contracted tissue under stain at the end range of available motion with the intent to incrementally increase the mobility of the glenohumeral joint with the expectation of plastic remodeling of the periarticular connective tissues to ultimately improve active and passive range of motion of the shoulder (Bonutti, McGrath, Ulrich, McKenzie, Seyler, & Mont, 2008; Mclure, Blackburn, & Dusold, 1994). Ideally, splints utilizing a static progressive stretch allow the patient to control the degree of stretch, to minimize the risk of overstretching and damaging the tissue (Bonutti et al., 1998). Such splints have shown success when used to treat the shoulder (Dempsey, Mills, Karsch, & Branch, 2011) and other joints (Bonutti et al., 2008; Doornberg, Ring, & Jupiter, 2006; Ulrich et al., 2010). Table 1

In treating joint stiffness, we believe clinicians and physiotherapists should adjust the amount of tensile stress applied to the periarticular tissues until a therapeutic result (increased ROM) is achieved. An insufficient amount of stress will have no therapeutic effect, where as an excessive dose will produce complications such as pain and inflammation. Three factors should be considered when calculating the prescribed amount of force delivered to soft tissues: intensity, duration and frequency.

As seen in Table 1 Bonnuti, Windau, Ables, & Miller (1994), in his study reported motion gains with the use of 30 min sessions up to three times per day as tolerated. Dempsey et al., (2011) performed six 10 min-bouts of end range stretching, daily, whereas Ibrahim et al.

Table 1
Use of low load prolonged stretch in different studies.

Reference	Frequency	Duration	Intensity	Joint	Main conclusion
Ibrahim et al. (2012)	Once daily for the first week, twice daily during weeks 2 and 3, and three sessions per day in week 4	6 sets of 5 min stretches (30′ total each session)	The endpoint for passive abduction was considered the point at which the patient began to experience pain	Shoulder	Use of a static progressive stretch orthosis for patients with shoulder adhesive capsulities resulted in significantly better range of motion within 1 month of beginning treatment than physical therapy alone
Dempsey et al. (2011)	Daily	10 min-bouts of end range stretching	Uncomfortable but beneath the pain threshold	Shoulder	A total end range time maximizing rehabilitation protocol is a safe, effective treatment option for patients with frozen shoulder
Ulrich et al. (2010)	1 to 3 sessions daily for a mean of 10 weeks	30-min stretching protocol	Uncomfortable but beneath the pain threshold	Elbow	Consistent improvements in restoring range of motion can be achieved with short treatment times by using a device based on the principles of static progressive stretch and stress relaxation in patients with posttraumatic elbow contractures
Bonutti et al. (2008)	One treatment session per day for the first 5 days, and then increased the frequency as tolerated to a maximum of three sessions per day	30-min treatment session	Until they felt a gentle stretch.	Knee	An orthosis that utilizes the principles of static progressive stretch may be a successful treatment for improving the range of motion and satisfaction of patients who have knee contractures.
Dorneberg et al. (2006)	3 times a day	30′ in each direction (flexion and extension)	–	Elbow	Static progressive splinting can help gain additional motion when standard exercises seem stagnant or inadequate
Bonutti et al. (1994)	3 times per day as tolerated	30′ each session	Uncomfortable but beneath the pain threshold	Elbow	Improvements in restoring elbow range of motion