Remember the Reason...

Physical therapy offers treatment that improves mobility and relieves pain, and reduces the need for surgery and prescription drugs.

Therapeutic Exercise Prescription
A scientific approach to dosing exercise in Physical Therapy

Introduction

Therapeutic Exercise has long been considered an integral component of the rehabilitation process and Physical Therapists are uniquely qualified in their ability to appropriately dose and prescribe exercise interventions for both healthy and injured populations. In celebration of National Physical Therapy month we will explore the science and theory in support of Therapeutic Exercise Prescription and present a few examples of how these concepts can be best applied clinically.

History

Much of the current knowledge of Therapeutic Exercise Prescription can be traced to the work of Oddvar Holten who was among the pioneers in the field of Manual Physical Therapy in Norway. In 1965 he founded Medical Exercise Therapy (MET) with the aim to "improve one or several functional properties by utilization of objectively graded activity". The Holten Curve (Fig 1) continues to be frequently referenced in the Physical Therapy literature to this day. Ola Grimsby, through his institute, furthered this work in the United States with the
foundation of Scientific Therapeutic Exercise Progressions (STEP) to incorporate the impact of biomechanics, histology, neurophysiology, the pathophysiology of trauma, nutrition and psychology.

**Exercise Variables**

When prescribing therapeutic exercise there are multiple variables that the Physical Therapist must consider. Among these are the specific exercise and its starting position, where in the range of motion the exercise will be performed, the amount of resistance, the type of contraction and the duration of the hold, the number of sets and repetitions, the speed of the motion, the work/rest ratio and the exercise frequency. The Physical Therapist applies his/her clinical reasoning skills to address these variables based on the specific tissue to be targeted, the current state of that tissue and the functional quality to be achieved.

**Specific Tissue Training**

The specific exercise to be performed and the associated starting position will be largely dependent on the tissue in lesion to be targeted and the present state of that tissue. Modified (pain-free) tension in the line of stress will be utilized to provide the optimal stimulus for regeneration of the Type 1 collagen found in tendons, ligaments and the annulus of the intervertebral disc while the Type 2 collagen found in articular cartilage and in the nucleus of the disc responds optimally to modified compression and decompression with component gliding.

**Functional Quality Improvement**

Therapeutic exercise can further be dosed based on the functional quality the Physical Therapist is aiming to improve. In the early stages of acute injury rehabilitation the initial treatment goals will be to inhibit pain and guarding and to restore motion around a physiological axis. Therapeutic exercise should be dosed to promote vascularity to the injured tissue, prevent further muscle atrophy and to reduce inflammatory byproduct. With reference to the Holten Curve this can best be achieved by working multiple sets of 30-50 repetitions at less than 60% of 1RM (resistance maximum). As the patient is progressed through the stages of rehabilitation the therapeutic exercise dosage is also
progressed to address the functional qualities of endurance, coordination, speed, strength and power.

**Determining % of 1RM**

In the patient population it is rarely, if ever, advisable to test 100% of 1RM secondary to pain and fear of overloading the tissue. Instead the Physical Therapist calculates the desired resistance by using clinical judgement and then closely monitoring the patient for signs of fatigue or loss of motor control. For example, if the goal is to exercise the external rotators of the shoulder for the functional qualities of strength/endurance we would reference the Holten Curve and pick a weight that we feel the patient can safely lift 16 times (75% of 1RM). Adjustments to that resistance can then be made based on patient performance and 1RM can be calculated using the formula shown below. (Fig. 2)

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\frac{A \text{ kg} \times 100\%}{B \%} = 1 \text{ R.M.}
\]

where A equals the lifted weight and B equals the percentage of intensity.

**Exercise Progression**

Once the tissue in lesion has been identified and the desired exercise intensity and resistance have been calculated the patient's exercise progression can be broken into 4 stages as described by Grimsby.

**Stage 1**

In stage 1 the patient presents with reduced active and passive range of motion with associated reduction in arthrokinematic motion. There will be pain, edema and increased tissue temperature as well as muscle guarding and poor coordination. Exercises will be dosed to inhibit pain and guarding and to promote vascularity. The Physical Therapist...
prescribes 3-5 exercises dosed as low as 40% of IRM in the presence of tonic muscle atrophy. Exercises are performed at low speed and within a pain free range of motion. For hyper-mobile joints the exercise is performed from mid to inner range of motion and for hypo-mobilities from mid to outer range of motion. Eccentrics are typically avoided secondary increased tissue stress as are isometrics as they inhibit blood flow.

Stage 2

Progression to Stage 2 is indicated when there is a reduction in pain intensity and it has dropped from constant to intermittent and range of motion has improved to within 10-25% of normal. Muscle guarding has resolved as has edema. Joint temperature and girth are normalized and the patient demonstrates improved coordination within the available range. The Physical Therapist can increase the number of repetitions through an increase in the number of exercises. Speed of performance can be increased and eccentrics can be incorporated. Mechanical blocks and other locking strategies can be lifted as the patient demonstrates improved motor control which also allows for progression out of the cardinal planes of movement.

Stage 3

At progression to Stage 3 the patient will demonstrate full arthrokinematic and osteokinematic motion and full, pain free weight bearing. Excessive repetitions or heavy loads may still result in pain and the patient will demonstrate continued deficits in coordination at increased speeds. All muscle guarding will be resolved and the patient is no longer tender to palpation over the primary tissue in lesion. In this stage the Physical Therapist will increase resistance towards 80% of 1RM with reduced repetitions to focus on the functional qualities of strength and power. Concentric lifts with eccentric return are emphasized to stabilize around the newly gained range of motion. Tri-planar motions are incorporated and isometric holds may be utilized to promote stability.

Stage 4

Stage 4 exercises are initiated when the patient demonstrates full active and passive range of motion and is pain free even with a significant level of exercise. There is good motor control throughout the range of motion but endurance remains limited during
performance of functional tasks. At this stage the Physical Therapist prescribes task or sport specific exercises dosed for strength, speed, endurance and muscle hypertrophy (80-90% of 1 RM). Tri-planar motions can include plyometrics and combinations of fast concentric and slow eccentric work to emphasize strength. Higher level balance and coordinative tasks are utilized to continue to challenge the patient to prepare for return to work, sport and daily activity.

**Conclusion**

Physical Therapists are uniquely prepared to prescribe Therapeutic Exercise to their patients and clients. By first identifying a tissue in lesion through a comprehensive examination process and then applying the optimal stimulus for regeneration of that tissue through a scientifically dosed exercise progression the highly trained staff at Fyzical Therapy and Balance Centers will exceed the goals and expectations of each and every patient.

Physical therapists and physical therapist assistants can help people recover from a wide variety of musculoskeletal disorders, reducing the need for surgery and prescription drugs. For more information on the benefits of physical therapy, visit the American Physical Therapy Association’s [Move Forward](#) website.

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Dr. Douglass is a Doctor of Physical Therapy and is board certified as an Orthopedic Clinical Specialist. He has been serving the physical therapy needs of the people of Southwest Florida for over a decade. Dr. Douglass completed his under graduate work at the University of Florida and then graduated Suma Cum Laude from Florida A&M University with a Bachelor's degree in Physical Therapy in 1991. He returned to the Ola Grimsby institute in...
2006 and earned fellowship status with the American Academy of Orthopedic Manual Physical Therapists. In 1998 he joined the Ola Grimsby Institute and began a clinical residency program specializing in Orthopedic Manual Therapy of the spine and extremities. He became a Certified Manual Physical Therapist in 2001 and earned his Doctor of Physical Therapy degree in 2002. In 2005, Dr. Douglass received his board certification as an orthopedic specialist by the American Board of Physical Therapy Specialties. He returned to the Ola Grimsby institute in 2006 and earned fellowship status with the American Academy of Orthopedic Manual Physical Therapists. He is well respected amongst his colleagues and his patients appreciate his skill and dedication. He is committed to keeping abreast of current research and ideas to assure his patients are being provided the latest in scientific & evidence based physical therapy innovations.

References