

Assessing Health & Functional Fitness

Lecture 6 – Flexibility and Health



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Outline

- ▣ Definitions of Flexibility
- ▣ Factors that influence Range Of Motion (ROM)
- ▣ Beighton Scale
- ▣ Other influences in Flexibility
- ▣ Assessment of Flexibility
- ▣ Flexibility program variables

Definitions of Flexibility

- “ability to be bent, pliable” The New Shorter Oxford English Dictionary (1993)
- Functional ability of a joint to move through its full range of motion (ROM) (ACSM 2010)
 - Functional ability - movement without incurring pain or a limit to performance
- “The ability of a joint to move through its full range of motion” (Brooks *et al.* 2000).
- There is little agreement about the definition of “normal” flexibility.
- Optimum flexibility is hard to assess, and varies with sport.
- More ROM is not necessarily better
- Inadequate flexibility can decrease performance of activities of daily living as well as some sports.

Further Definitions

- Flexibility refers to the extensibility of periarticular tissues to allow normal or physiological motion.
- Laxity refers to the stability of a joint (Saal, 1987).
 - Excessive joint laxity can be the result of injury or heredity condition.
- Hypermobility refers to a range of motion in excess of the accepted normal motion in most of the joints (Alter, 1996).

Factors that Influence ROM

- Range of Motion (ROM) is joint specific, and results from a combination of factors; including adequate warm-up
- Structure of Joint - (47%)
 - Determines degree of freedom of movement
 - Hinge vs ball and socket joint
- Rigidity of Ligaments (10%)
 - Help stabilize and protect joints from excessive motion during dynamic movements
 - Restrict ROM and offer support at end of ROM
- Extensibility of periarticular tissues - muscle and tendon (41%)
 - Component that can be modified most significantly and influenced by flexibility training
 - Length of muscle and level of neurological innervation in muscle being stretched

ROM outside Norms?

- ▣ Age
- ▣ Gender
- ▣ Sporting populations/ Occupations
- ▣ Pregnancy
- ▣ Congenital factors
- ▣ Past History

Beighton Scale

- Scoring system to determine excessive ROM throughout the body.
- Benign Joint Hypermobility Syndrome (BJHS)
- 9 point testing procedure

Other influences on Flexibility

- Nervous system activity
 - Sudden stretch of a muscle stimulates muscle spindle and reflex contraction
 - Important for proprioception and controlling muscle length
 - Slow static stretches, spindle activity increases for about 10 sec then diminishes greatly
 - This can also help alleviate muscle cramps
- Intracapsular structures
 - articular cartilage and synovial membranes facilitate smoothness of movement while maintaining integrity of joint
- Soft tissue
 - compression of soft tissue by adjacent segments contributes to termination of ROM
 - Eg obese or very heavy musculature

Assessment of Flexibility

- Measurement made visually or with special instrumentation
- Utilise active or passive movement of subject
- Precision in assessment techniques enhances both accuracy and reliability
 - Proper identification of landmarks
 - Consistency in the inclusion or exclusion of a warm-up is important for reliability
 - Starting position and body position for measurements
- Visual assessment (qualitative) - inaccurate for both spinal and extremity evaluation
 - Useful for fitness screening, group evaluation and field testing
 - Degree of completion of assessment in standard position - see lab manual
 - Eg - Finger tips touching (or not) with combined bilateral rotation of shoulders and elbow flexion

Assessment of Flexibility



Assessment of Flexibility



Quantitative Assessment of Flexibility

- Measurement Devices
 - Indirect - linear - sit and reach apparatus,, tape measures
 - Direct - ROM in degrees - Goniometer
 - Goniometer is inexpensive and portable
 - Dynamic Flexibility can be measured with stop motion video with reflective markers on bony landmarks
 - Similar to motion capture for video games and animation
- Biomechanical Assessment (Level 5)

Goniometric Reading

Table 10.2 Universal Goniometer Measurement Procedures

			GONIOMETER POSITION			
Joint	Body position	Axis of rotation	Stationary arm	Moving arm	Stabilization	Special considerations
Shoulder						
Extension	Prone	Acromion process	Midaxillary line	Lateral elpcondyle of humerus	Scapula and thorax	Elbow is slightly flexed and palm of hand faces body.
Flexion	Supine	Same as extension	Same as extension	Same as extension	Scapula and thorax	Palm of hand faces body.
Abduction	Supine	Anterior axis of acromion process	Midline of anterior aspect of sternum	Medial midline of humerus	Scapula and thorax	Palm of hand faces anteriorly; humerus is laterally rotated; elbow is extended.
Medial/lateral rotation	Supine	Olecranon process	Perpendicular to floor	Styloid process of ulna	Distal end of humerus and scapula	Arm is abducted 90°; forearm is perpendicular to supporting surface in mid-pronated-supinated position; humerus rests on pad so that it is level with acromion process.
Elbow						
Flexion	Supine	Lateral epicondyle of humerus	Lateral midline of humerus	Lateral midline of radial head and styloid process	Distal end of humerus	Arm is close to body; pad is placed under distal end of humerus; forearm is fully supinated.
Forearm						
Pronation	Sitting	Lateral to ulna styloid process	Parallel to anterior midline of humerus	Lies across dorsal aspect of forearm, just proximal to styloid processes of radius and ulna	Distal end of humerus	Arm is close to body, elbow flexed 90°; forearm is midway between supination and pronation (thumb toward ceiling).
Supination	Sitting	Medial to ulna styloid process	Parallel to anterior midline of humerus	Lies across ventral aspect of forearm, just proximal to styloid processes of radius and ulna	Distal end of humerus	Testing position is same as for pronation of forearm.
Wrist						
Flexion and extension	Sitting	Lateral aspect of wrist over the triquetrum	Lateral midline of ulna, using olecranon and ulnar styloid processes for reference	Lateral midline of fifth metacarpal	Radius and ulna	Client sits next to supporting surface, abducts shoulder 90°, and flexes elbow 90°; forearm is in mid-supinated-pronated position; palm of hand faces ground; forearm rests on supporting surface; hand is free to move.
Radial or ulnar deviation	Sitting	Middle of dorsal aspect of wrist over capitate	Dorsal midline of forearm, using lateral humeral epicondyle as reference	Dorsal midline of third metacarpal	Distal ends of radius and ulna	Same as for wrist flexion.

(continued)

Goniometric Reading

Table 10.2 (continued)

Joint	Body position	Axis of rotation	GONIOMETER POSITION		Stabilization	Special considerations
			Stationary arm	Moving arm		
Hip						
Flexion and extension	Supine; prone	Lateral aspect of hip joint, using greater trochanter as reference	Lateral midline of pelvis	Lateral midline of femur, using lateral epicondyle for reference	Pelvis	Knee is allowed to flex as range of hip flexion is completed; knee is flexed during hip extension.
Abduction and adduction	Supine	Centered over anterior superior iliac spine	Horizontally align arm with imaginary line between anterior superior iliac spines	Anterior midline of femur, using midline of patella for reference	Pelvis	Knee is extended during abduction.
Medial/lateral rotation	Sitting	Centered over anterior aspect of patella	Perpendicular to floor	Anterior midline of lower leg, using crest of tibia and point midway between malleoli for reference	Distal end of femur; avoid rotation and lateral tilt of pelvis	Client sits on supporting surface, knees flexed 90°; place towel roll under distal end of femur; contralateral knee may need to be flexed so that hip being measured can complete full range of lateral rotation.
Knee						
Flexion	Supine	Over the lateral epicondyle of femur	Lateral midline of femur, using greater trochanter for reference	Lateral midline of fibula, using lateral malleolus and fibular head for reference	Femur to prevent rotation, abduction, and adduction	As knee flexes, the hip also flexes.
Ankle						
Dorsiflexion and plantar flexion	Sitting	Over the lateral aspect of lateral malleolus	Lateral midline of fibula, using head of fibula as reference	Parallel to lateral aspect of fifth metatarsal	Tibia and fibula	Client sits on end of table with knee flexed and ankle positioned at 90°.
Subtalar						
Inversion and eversion	Sitting	Centered over anterior aspect of ankle midway between malleoli	Anterior midline of lower leg, using the tibial tuberosity for reference	Anterior midline of second metatarsal	Tibia and fibula	Client sits with knee flexed 90° and lower leg over edge of supporting surface.
Lumbar spine						
Lateral flexion	Standing	Centered over posterior aspect of spinous process of S1	Perpendicular to the ground	Posterior aspect of spinous process of C7	Pelvis to prevent lateral tilt	Client stands erect with 0° of spinal flexion, extension, and rotation.
Rotation	Sitting	Centered over superior aspect of client's head	Parallel to imaginary line between tubercles of iliac crests	Imaginary line between two acromion processes	Pelvis to prevent rotation	Keep feet flat on floor to stabilize pelvis.

General Guidelines for Flexibility Testing

- Have client perform general warm-up followed by static stretching prior to the test.
- Avoid fast, jerky movements, and stretching to the point of pain.
- Administer three trials of each test item.
- Compare client's best score to norms to obtain a flexibility rating for each test item.
- Use the test results to identify joints and muscle groups in need of improvement.

Quantitative Measurements

■ Sit-reach Test

- Measures flexibility of low back, glutes and hamstrings.
- Link to LBP however not definitely proven
- No distinction to individualised areas
- Difference provides data for comparison

Quantitative Measurements

- Knee to Wall (Weight Bearing Lunge)
 - Determines Dorsiflexion ROM in at Talocrural joint
 - Reduced ROM associated with increased risk of injury in sporting population

Quantitative Measurements

- Back Scratch Test
 - Determines functional movement in the shoulders
 - Reduced ROM associated with reduced function

Quantitative Measurements

- Other Clinical Tests
 - Obers Test
 - Elys Test
 - Three point - Thomas Test
 - Straight Leg Raise
 - Glute Medius Length Test
 - Piriformis Length Test
 - Trapezius Length Test

Benefits of Flexibility Training

- ▣ Increased physical performance
- ▣ Decreased risk of injury (but not due to inclusion as part of a warm-up)
- ▣ Increased blood supply and nutrients to joint structure
- ▣ Increased quality and quantity of joint synovial fluid
- ▣ Increased muscular coordination
- ▣ Improved muscular balance, posture and postural awareness
- ▣ Decreased muscle viscosity, causing contractions to be easier and smoother

Benefits of Flexibility (cont)

- Reduced muscular soreness
- Promotion of relaxation (reduced muscular tension and cramps)
- Decreased risk of low back pain
- Reduced stress and tension
- Increased enjoyment
- Promotes self-discipline
- Unification of body, mind and spirit (e.g. Yoga)
- Improves ease and efficiency of movement
- Increased Range of Motion
- Improves skill in sport

Reasons why stretching before exercise may not prevent injury

- An increase in muscle compliance may cause tissues to rupture more easily.
- Stretching before exercise will have no effect for activities where excessive muscle length is not an issue.
- Stretching will not affect muscle compliance during eccentric activity, where most strains are believed to occur.
- Stretching can produce damage at the cytoskeleton level.
- Stretching appears to mask muscle pain in humans.

Flexibility Training Program

- Athletes should stretch following practice or as a separate session (after sufficient warm up)
 - Muscle is warm, collagen is elastic which allow greater stretch
 - May decrease muscle soreness
- Training Program
 - A planned, deliberate, and regular program of exercises that can permanently and progressively increase the useable range of motion of a joint or set of joints over a period of time (Corbin and Noble, 1980).
 - NASM guidelines? 15-30secs and 2-4 reps.
- Stretching recommended after sitting or standing for long periods - helps prevents discomfort (not enough to count as a training program)