FLEXIBILITY AS IT RELATES TO HEALTH AND PERFORMANCE

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FLEXIBILITY

- Flexibility, the ability to move the joints through their full range of motion, is an important factor in achieving wellness throughout the life span.
- It enables us to reach, bend, twist, and perform movements without excessive tightness or stiffness.
- Disuse, injury, scar tissue, excessive body fat, and muscle imbalances are common factors associated with loss of range of motion

DEFINITION

- Ability to move freely, without restriction
- Ability to move a single joint or series of joints smoothly and easily through an unrestricted, pain-free ROM.
- extensibility of soft tissues that cross or surround joints—muscles, tendons, fascia, joint capsules, ligaments, nerves, blood vessels, skin), which are necessary for unrestricted, pain-free movements of the body during functional tasks of daily living.
- used interchangeably with mobility.

BENEFITS OF FLEXIBILITY

- Decreased aches and pains
- Enhanced ability to move freely and easily
- Possible decreased risk of injury
- Recovery from injury
- Enhanced athletic performance
- Reversal of age – related flexibility decline
- Improve posture and appearance
- Decreased muscle soreness after exercise
- It feels good.

CAUTIONS

- Cold and tight muscles
- Stretching is not a competitive activity
- Overstretching leads to joint instability
- Strengthen muscles that you stretch
  - Static stretching immediately preceding strength activities decreases performance approximately 10 percent.
  - Studies also show decreased vertical jump performance immediately following PNF stretching

FACTORS AFFECTING FLEXIBILITY

- Joint structure
- Soft tissues
- Inactivity
- Muscle temperature
- Age
- Genetics
- Gender
- Obesity
- Injury and neural factors

LIMITATIONS TO FLEXIBILITY

- Anthropometric factors (Increased adiposity)
- Restricted movement
- Adhesions
- Contracture

TYPES OF FLEXIBILITY

- There are two basic types of flexibility: static and dynamic.
- **Static flexibility** refers to the range of motion that can be achieved through a slow, controlled stretch.
- **Dynamic flexibility** is the range of motion achieved by quickly moving a limb to its limits.

STATIC STRETCHING

ROM that can be achieved through a slow, controlled stretch.

- Here, stretching force is provided by gravity or the force of one limp pulling on the other.
- When a muscle is stretched and held at a constant length, after a period of time there is a gradual loss of tension and muscle lengthening.

- Most commonly used.
- Does not activate the stretch reflex.
- Does not increase muscle temperature.
- Associated with limited muscle soreness.

DYNAMIC STRETCHING

- Dynamic - Degree to which an active muscle contraction moves a body segment via the available Joint ROM
- Is movement through a range of motion with an emphasis on maintaining both speed & force; impacted by same variable as static flexibility plus neuromuscular variables, balance, speed, and torque.
- Dependent on :
  - Degree to which a joint can be moved by a muscle contraction
  - Amount of tissue resistance met during the active movement
- Associated with increased muscle soreness
- Not used much in personal fitness programs because of increased risk of injury
- It initiates stretch reflex

HEALTH RELATED USE

- While both types of stretching can increase flexibility, static stretching is preferred in health-related fitness programs because it is highly effective and carries little risk of muscle or joint strain.
- Static and dynamic stretching may be performed actively or passively.
- With **active stretching,** ones muscle force is used to stretch yourself.
- With **passive stretching,** someone or something else assists with a stretch. The assist could be gravity, body weight, a strap, or leverage.
- Both active and passive stretching improve flexibility, but passive stretching is more commonly used

TYPES OF STRETCHING

- There are two (2) main categories of stretching:
  1. Passive – a stretch in which the elastic components of the muscle are relaxed and the portion of muscle most likely to be loaded is the connective tissue (e.g., a static stretch).
  2. Active – a stretching technique modeled after traditional strength-training workouts. Stretches are held very briefly in sets of a specified number of repetitions, with a goal of isolating an individual muscle in each set.

OTHER FORMS OF STRETCHING

- Static stretching (passive) is a low-force, long duration stretch that holds the desired muscles at their greatest possible length for 15-20 seconds.
- Ballistic stretching is a high-force, short-duration stretch using rapid bouncing movements.
- Proprioceptive Neuromuscular Facilitation (PNF) is a method of promoting the response of neuromuscular mechanisms through the stimulation of proprioceptors in an attempt to gain more stretch in muscle; often referred to as a contract/relax method of stretching.

FIELD ASSESSMENT OF FLEXIBILITY FOR PRESCRIPTION

- Field tests for flexibility could be reasonably used for the following reasons;
  - Locate individual problem areas for the purposes of exercise prescription. For example, if shoulder flexibility is found to be very poor, exercises to improve flexibility in this area could be recommended.
  - As with tests for aerobic fitness, flexibility tests could be used to gauge progress in a flexibility and or stretching program.

METHODS

- If one has access to the rather simple pieces of equipment described below, several easily administered tests can be conducted.
- There are three popular modalities for assessing joint ROM in the field.
- **Goniometry:** A goniometer is basically a protractor with a movable arm. The axis of rotation is positioned at the joint axis of rotation and the degees of ROM then measured.
- **Leighton Flexometer:** This is a strap-on device with a gravity assisted dial. The dial is initially set at zero and as the limb moves throughout the ROM, gravity turns the dial. At the full extent of the motion, the dial is locked and the reading recorded.

METHOD CONTD

- **Some tests have been designed which only require a ruler, tape measure and/or a protractor.** The person performs a given movement to the fullest extent of their ability and then the amount of movement or the angular range of motion is measured. (One could probably put the "**sit-and-reach**" in this category.)
- Flexibility tests are similar to stretching exercises. It would therefore be better to provide a brief warm-up before attempting any assessment. This could be a brisk 5 minute walk, 5 minutes a cycle ergometer, or 5 minutes on a treadmill, all to the point of light perspiration. On the other hand, others feel that warm-ups are not essential if the movements are slow and controlled, and argue that life's activities are not preceded by a warm-up

TESTS OF FLEXIBILITY

Clinical assessment - Leighton Flexometer, the electrogoniometer, and the goniometer; provide rotary measure; degrees of rotation around a 360^0 arc

Practical tests – provide linear measure; tape measure, yardstick

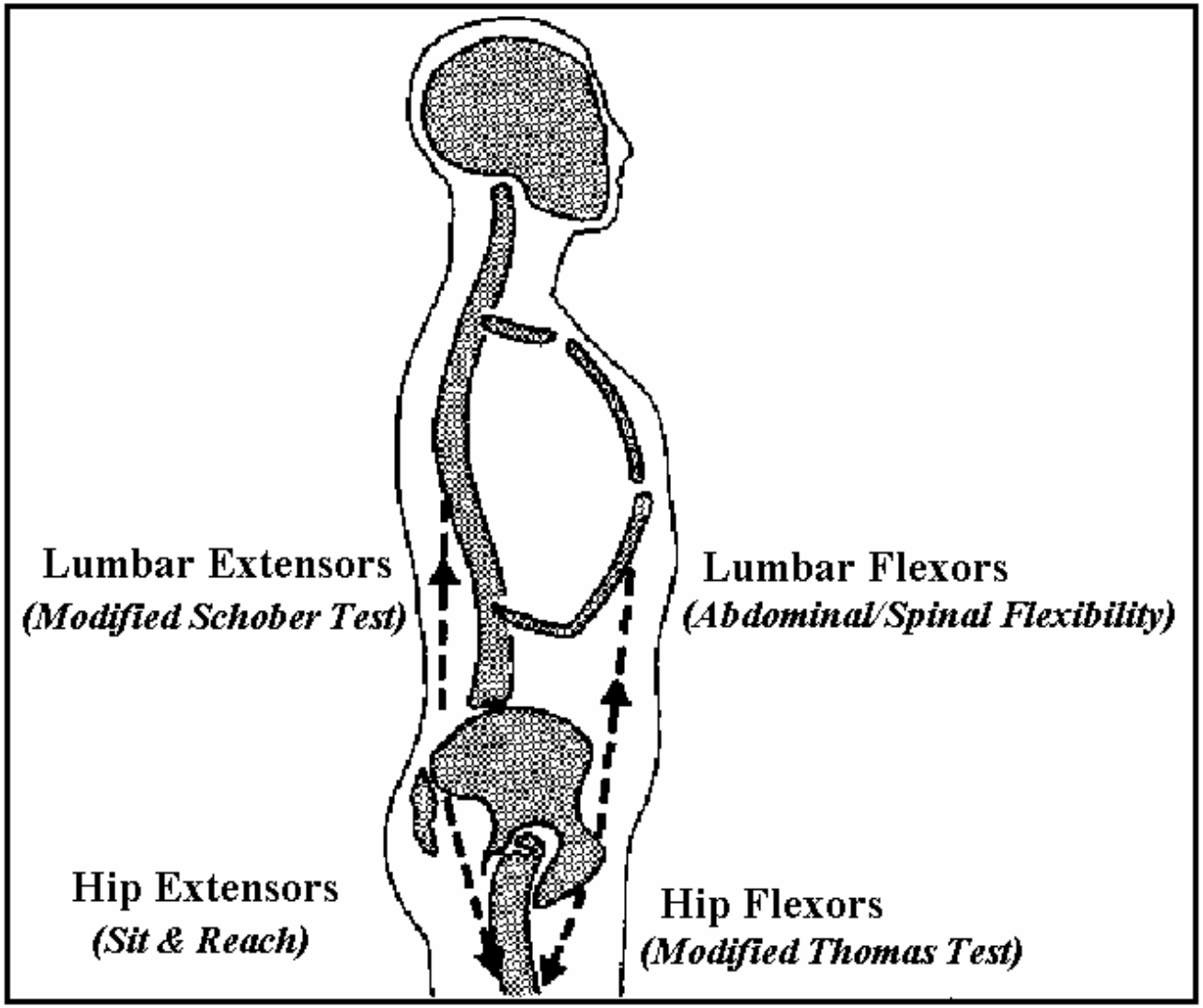
Relative flexibility **-** test score (movement) compared with the length or width of a specific body part

Absolute flexibility **-** measure only the movement in relation to an absolute performance goal

Pelvic Tilt Assessment

- In order to help prevent future back problems, the orientation of the pelvis with respect to the entire spine in standing posture should be estimated.
- There are basically four quadrants to assess;
  - lower back
  - Abdomen
  - the hamstrings and
  - the hip flexors.
- If we can determine the status of two or more of these quandrants, we should be able to estimate which muscles need to stretched (or strengthened) for lower back health.

Pelvic Tilt Assessment



Hamstring Flexibility

- **Sit-and-Reach:** The Sit-and-Reach is unquestionably the most common test of flexibility used with the public, due to the feeling that a poor score here might be correlated with a higher chance of future back problems.
- Have the person remove his/her shoes and sit facing the flexibility box, with knees fully extended.
- The feet should be 4 inches apart with fleet flat against (and heels touching) the end board.
- Extend the arms straight out, palms down, with the fingers of both hands overlapping.
- Have them extend forward as far as possible holding the position for 1 to 2 seconds.
- The score will be the most distant point touched on the fourth trial.

Hamstring Flexibility

- In scoring the sit and reach, the more common nomograms use centimeters and not inches. In addition, be aware that many suggest that the "footline" be placed at 23 cms. In other words, if you reach 6 cms beyond the plane of foot contact with the box, you have reached 6 cm but your score would be 23+6 = 29 cm.
- The ACSM's Health Fitness Instructor's Manual proposes the use of the following standards:

Rating	Score (cms)
Good	>35
Acceptable	20-30
Needs Work	<20

- Raw score in centimeters _____
- Rating _____

MODIFIED SIT AND REACH TEST

- Gravity unassisted analogue of toe-touch test
- To measure hamstring and low back flexibility.
- Equipment Needed: a 12 inch high box and a ruler
- PROCEDURE:
- Sit on the floor with your back and head resting against a wall. Your legs are straight in front of you, thighs and calves resting on the floor.
- The PT places the box flat against your feet.
- Place one hand on top of the other.

MODIFIED SIT AND REACH TEST

- Reach your arms toward the box without taking your back or head away from the wall. The PT places the ruler on the box with the zero measurement touching your finger tips. This is your starting position for the test. Make sure the ruler does not move during the test.
- Slowly bend forward, peeling your head and back off the wall. Keep your knees straight and your hands level with each other. Then return to starting position.
- Repeat this stretch three times. On the third try, hold the position for 2 seconds with the PT measuring the mark on the ruler that your fingertips touch. This completes the first trial of this test.
- 3 Repetitions

MODIFIED SIT AND REACH TEST

MODIFIED SIT AND REACH TEST SCORING

- Excellent = >24in (>61cm)
- Very Good = >21.5in (>55cm)
- Good = >20.5in (>52cm)
- Average = 19in (48cm)
- Fair = 18.25in (46cm)
- Poor = 16.5in (42cm)
- Very Poor = <12in (<30cm)

Hip Flexor Flexibility

- **Sling Test or Modified Thomas Test:** The Sit-and-Reach will tell you if clients need work on hamstring (hip extensor) flexibility. The Modified Thomas Test will help determine if your clients need stretching exercises for the hip flexors (specifically iliopsoas and rectus femoris). This will often be the case.
  - Lie on the back with both knees bent.
  - Pull one knee in toward the chest and hold it there tightly. (There are no specifications on which knee.)
  - Gently straighten the other leg out until it can go no further, with the knee still held close to the chest.
  - Measure the distance (in inches) of the bottom of the (partially) straightened knee to the floor in inches

Hip Flexor Flexibility

- **Scoring**
- Excellent: With knee held against the chest, the other leg can lie flat against the ground.
- Average: Able to hold the knee against the chest with the other knee 2 to 4 inches off the ground. (Some hip flexor stretches advised.)
- Fair: The knee of the extended leg remains 4 to 8 inches off the ground. (Definite need to stretch hip flexors.)
- Poor: Unable to get on knee firmly to the chest, or knee of straightened leg remains move than 8 inches off the ground. (Hip flexor stretch needs much work.)

Lower Back Flexibility

- **Modified Schober Test:** The Modified Schober test is designed by physical therapists to specifically assess lower back flexibility.
- Subject stands with the feet 15 cm apart.
- The examiner stands behind the subject and makes three marks;
  - one mark behind the lumbosacral junction,
  - a second mark on a spinous process 10 cm above the first mark (measure to the nearest millimeter)
  - a third mark 5 cm below the first mark
- Place a tape measure between the inferior and superior most marks, with "0" at the inferior mark.
- Pressing the tape against the subject's lower back, have them bend forward as far as possible keeping the knees straight. Keep the tape aligned in the middle of the back and record the distance between the most superior and inferior marks at the end of the ROM. The ROM to be recorded as the assessment is the difference between the 15 cm and the length measured at the end of the motion.

Lower Back Flexibility

- With respect to interpretation, varying authorities have listed "normal" as anything from a 4 cm difference in the tape length to a 10 cm difference. ***Therefore, we will tentatively suggest this range as being normal, with 4 cm as the criterion value minimum.***
- Score_____ cms

TRUNK ROTATION TEST

- To measure the flexibility of the trunk
- Suitable for golf or tennis players
- Equipment needed: a wall and a piece of chalk
- Contraindications: osteoporosis, back pain which is aggravated by twisting
- Procedure:Draw a vertical line down a wall using chalk
- Stand a shoulder's width away from the wall with your back to the wall directly in front of the line. Your feet should be shoulder width apart.

TRUNK ROTATION TEST

- Extend your arms in front of you, elbows straight, arms parallel to the floor.
- Without moving your feet twist your trunk to the left and touch the wall behind you with your finger tips. Arms stay extended and parallel to the floor throughout the movement. Your partner places a chalk mark on the wall where your fingers touch.
- Do the same motion to the right. Again your partner marks where your fingers touch the wall.
- Repeat once more to each side.
- Measure the distance from the vertical line to each chalk mark your partner made.

TRUNK ROTATION TEST SCORING

- Excellent= 8in (20cm)
- Very Good = 6in (15cm)
- Good = 4in (10CM)
- Fair = 2in (5cm)
- Poor = 0in (0cm)
- Note: 0 = your fingers touching the vertical line. Positive scores are points beyond the line that you were able to reach.

TRUNK ROTATION FLEXIBILITY TEST

Neural Factors

- **Myotatic Stretch Reflex** – muscular reflex created by excessive muscle spindle stimulation to prevent potential tissue damage.

- The reflex evoked when the patellar ligament is tapped directly below the kneecap during an examination is a classic example of the stretch reflex.

Neural Factors

- Reciprocal innervation – when you contract a muscle, its antagonist group relaxes. This allows you to then stretch that antagonist group more efficiently when it is relaxed and its opposing muscle group is contracted.

- Muscle spindles – these respond to actual stretch, not speed. When a muscle fiber is overstretched, muscle spindles will fire and will cause the muscle to contract to protect itself.

MECHANICS OF STRETCHING

- There are two (2) stretching methods:
  - Elastic – elongation of tissues that recovers when the tension is removed; referred to as temporary or recoverable elongation (deformation); compared to spring-like model.
  - Plastic – elongation in which the deformation to tissue remains even after the tension is removed; referred to as permanent or non-recoverable elongation; compared to a hydraulic cylinder.

MECHANICS OF STRETCHING

- Connective tissue is composed of non-elastic collagen fibers and a small number of elastic fibers within a protein matrix that creates various soft tissue structures including tendons, ligaments, & fascia.

- Connective tissue has a very high tensile strength, giving it the ability to support and protect underlying structures from injury.

- Organized connective tissue is visco-elastic – combination of two (2) mechanical properties: elasticity & viscosity.

GUIDELINES FOR FLEXIBILITY DEVELOPMENT

- Part of a balanced fitness program
- Goal is to develop and maintain an adequate ROM for ease of movement in ADLs
- Flexibility gains are proportional to the overload applied: frequency, intensity and time of stretching
- A session can last 10-30" depending on the number of stretches and length of repetitions

PRINCIPLES OF STRETCHING

- Most experts recommend stretching both before & after intense activity albeit for different reasons.

- Professionals agree that daily stretching is best, and, at the very least, stretching should be performed before and after activity sessions.

PRINCIPLES OF STRETCHING

- When designing a stretching program, keep the following in mind:
    1. Connective tissue elongation (plastic) is the primary target when stretching.
    2. The two most important factors influencing stretching are intensity & duration.
    3. Elevated tissue temperature facilitates range of motion.
    4. Flexibility is specific to each joint or muscle group.
    5. Proper alignment for each stretch is critical.
    6. Most stretches should be held for 10-30 seconds and repeated 2-3 times each.

PRESCRIPTION FOR FLEXIBILITY

- Frequency - Stretch at least 2 to 3 days a week, daily if possible. Greater flexibility is produced by more frequent stretching.

- Intensity - Low-intensity stretching is best.

  Progress at your speed. Stretching is not competitive. Flexibility changes from day to day, and on some days you might not be able to stretch as far as you did the day before. Stretch slightly beyond the normal range of motion, to the point of tension, and hold. Do not force a stretch.

PRESCRIPTION FOR FLEXIBILITY

- Time - The ACSM recommends a 10- to 30- second stretch, during cool-down for optimal benefit.

- Repetitions - At least four 10- to 30-second sustained stretches for each muscle group are recommended.

REFERENCES

- CARVALHO, Ana Cristina Gouvêa; PAULA, Karla Campos de; AZEVEDO, Tânia Maria Cordeiro de and NOBREGA, Antonio Claudio Lucas da. Relationship between muscular strength and flexibility in healthy adults of both genders. Rev Bras Med Esporte [online]. 1998, vol.4, n.1, pp. 2-8. ISSN 1517-8692. http://dx.doi.org/10.1590/S1517-86921998000100002.
- www.mhhe.com/robbinsfit2
- Norkin, Cynthia C. & D. Joyce White. (1995). Measurement of Joint Motion: A Guide to Goniometry. Philadelphia: F.A. Davis Company.
- Howley, E. et al. (1991). Health Fitness Instructor's Handbook (2nd ed.), Champaign: Human Kinetics.
- Nieman, D. et al.(1990). Fitness and Sports Medicine: An Introduction, Palo Alto: Bull Publishing Co.
- Pollock, M. et al. (1990). Exercise in Health and Disease: Evaluation and Prescription for Prevention and Rehabilitation (2nd ed.), Philadelphia: W.B. Saunders Co. (Pollock lists extremely detailed nomographic data on several tests.)