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Module 3:

Musculoskeletal assessment

Introduction

The musculoskeletal system extends throughout the entire body and assessment is therefore extensive. It includes assessment of bones, joints and muscles, as well as posture, muscle strength and range of motion.

As with most body systems, the musculoskeletal system is reliant upon other body systems for normal function, but is in turn necessary for the normal functioning of other systems. For example, a balanced diet incorporating calcium is necessary for healthy bones, but good range of motion is needed to open the mouth and chew in order to have a healthy diet.

You will mainly use interview, inspection and palpation as your assessment techniques for this system. A thorough assessment of this system requires the person to move through a number of positional changes, so an environment that allows for safe movement is important. The clinician must plan the assessment stages so that the older person is comfortable and is not required to change positions unnecessarily.

Diagram 1: Anterior and posterior view of the skeletal system

The skeleton

- The skeleton is the bony framework of the body.
- There are 206 bones in the human body.

Bones

Bones are a form of specialised connective tissue and are needed for:

- Support (the ability to stand erect)
- Movement (serve as levers)
- Protection (of vital organs and spinal cord)
- Production of red blood cells
- Reservoir for storage of essential nutrients (calcium and phosphorus)

There are two types of bone tissue:

1. Compact bone
   - Compact bone makes up the shaft and outer layers.

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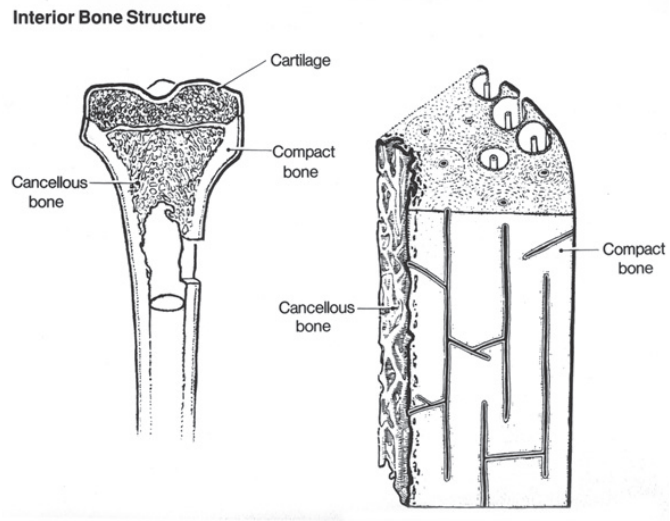
- Compact bone is very hard and dense.
- It consists of microscopic cylindrical structures that run parallel to the long axis of a bone.
- These cylindrical-shaped structures are the Haversian systems and are laid down in concentric rings called lamellae. Haversian systems run along the length of the long bone and provide blood supply to the osteocytes.

Diagram 2: The anatomy of bone (showing the hard and soft layers)



2. Spongy/trabecular/cancellous bone
   - Spongy bone contains numerous spaces and makes up the ends and centres of the bone.
   - Spongy bone is a network of irregularly shaped sheets and spikes of bone (trabeculae), which are only a few cell layers thick. It makes up the bulk of the interior of most bones.
   - The spaces between the trabeculae contain red or yellow marrow, depending on a person's age and on which bone it is.
   - There are no blood vessels within the matrix of spongy bone, but blood vessels are nearby in the marrow spaces.
   - Exchange of nutrients and gases occurs between capillaries in the marrow and the interstitial fluid of the marrow.

Cells of the bone

- Osteoblasts take minerals from the extracellular fluid around them and form new bone matrix on the surfaces of the bones.
- As part of this process some osteoblasts become osteocytes. Osteocytes live within the bone itself, and use filaments to obtain information about stresses and strains from the outside environment to the other bone cells.
- Osteoclasts are the cells that re-absorb bone. They re-absorb bone by moving to all different parts of the bone and releasing acids and enzymes which break down the minerals and proteins that make up the bone matrix and other parts of bone.

Bone mass

Bone mass is maintained by a balance between the activity of osteoblasts which form bone, and osteoclasts which break it down. Bones contain most of the calcium in the body. When blood calcium levels decrease below normal, calcium is released from the bones and when blood calcium levels are increased, the excess calcium is stored in the bone matrix. Vitamin D is necessary for absorption of calcium through the gut:

- Hematopoiesis is the formation of blood cells and mostly takes place in the red marrow of the bones
  - In adults, red marrow is limited to the spongy bone in the skull, ribs, sternum, clavicles, vertebrae and pelvis
  - The formation of red and white blood cells and platelets occurs in the red bone marrow.

Types of bones

- ***Short*** – their length, height and width are usually the same. Bones included here are carpal and tarsal bones in the hands, wrists, feet and ankles
- ***Flat*** – protect underlying organs and soft tissues, as well as provide attachments. Bones included here arescapula, sternum, ribs, patella and skull
- ***Irregular*** – irregular in shape such as vertebrae, sacrum, coccyx
- ***Long*** – hard, dense bones that provide strength, structure, and mobility. The clavicle, tibia, fibula, radius, ulna are a few examples of long bones.

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Muscles

Muscles are formed from a type of tissue that consists of elongated cells capable of contracting

- Three types
  - Smooth muscle (involuntary)
  - Cardiac muscle (involuntary)
  - Skeletal (voluntary)

- Muscles can be voluntary or involuntary.
- The muscular system is composed of specialised cells called muscle fibres. Their predominant function is contractibility.
- Muscles, where attached to bones or internal organs and blood vessels, are responsible for movement.
- Nearly all movement in the body is the result of muscle contraction.
- All muscles must work in pairs. This is because they can contract and relax but cannot push or stretch themselves.
- The term 'involuntary' means the person cannot contract and relax the muscle through conscious control. Smooth muscle contracts and relaxes automatically; for example, blood vessels, stomach.
- Skeletal muscle attaches to the skeleton and is voluntary because you have direct control over when you want to make a movement.
- The voluntary muscles are regulated by the parts of the brain known as the cerebral motor cortex and the cerebellum.
- For example, if you want to move, the motor cortex sends an electrical signal through the spinal cord and peripheral nerves to the muscles, causing them to contract.

Central and peripheral nervous system control of muscle

- The motor cortex on the right side of the brain controls the muscles on the left side of the body and vice versa.
- The cerebellum coordinates the muscle movements ordered by the motor cortex.
- Sensors in the muscles and joints send messages back through peripheral nerves to tell the cerebellum and other parts of the brain where and how the arm or leg is moving, and what position it is in.

This feedback results in smooth, coordinated motion.

- If you want to lift your arm, your brain sends a message to the muscles in your arm and you move it.
- When you run, the messages to the brain are more involved, because many muscles have to work in rhythm.
- In addition to movement, muscle contraction also fulfils some other important functions in the body, such as posture, joint stability, and heat production.
- Posture, such as sitting and standing, is maintained by muscle contraction.
- The skeletal muscles are continually making fine adjustments that hold the body in stationary positions.
- Heat production, to maintain body temperature, is an important by-product of muscle metabolism.
- Nearly 85 per cent of heat produced in the body is the result of muscle contraction.

The human body has more than 650 muscles, which make up half of a person's body weight.

- Muscles are connected to bones by tough, cord-like tissues called tendons, which allow the muscles to pull on bones.
- The tendons of many muscles extend over joints and in this way contribute to joint stability. This is particularly evident in the knee and shoulder joints, where muscle tendons are a major factor in stabilising the joint.

Tendons

- A tendon is a tough, flexible band of fibrous tissue.
- Tendons connect muscle to the bones.
- When a muscle contracts, it pulls on a bone to cause movement.
- It transmits the force of the muscle contraction to the bone.
- Tendons grow into the bone and form a tough mineralised connection.
- This connection creates a permanent bond that is extremely tough to break.
- Despite their toughness, tendons can be damaged if overstrained or improperly cared for. Overuse can cause the collagen fibres in the tendon to form small tears.

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Ligaments

- Ligaments are the fibrous, slightly elastic tissue that hold one bone to another in the body, forming a joint.
- Ligaments control the range of motion of a joint, preventing your elbow from bending backwards, for example, and stabilising the joint so that the bones move in the proper alignment.
- Ligaments are composed of strands of collagen fibres.
- While ligaments are slightly stretchy, they are arranged in a criss-cross pattern, which prevents the joint itself coming loose. The knee is a common area for ligament damage.
- If ligaments are stretched, either by injury, excess strain on a joint or by improper stretching techniques, the joint will become weaker as the stretched ligaments will be unable to support it.
- People who are said to be 'double-jointed' simply have extra long ligaments that allow their joints to stretch beyond the normal range.

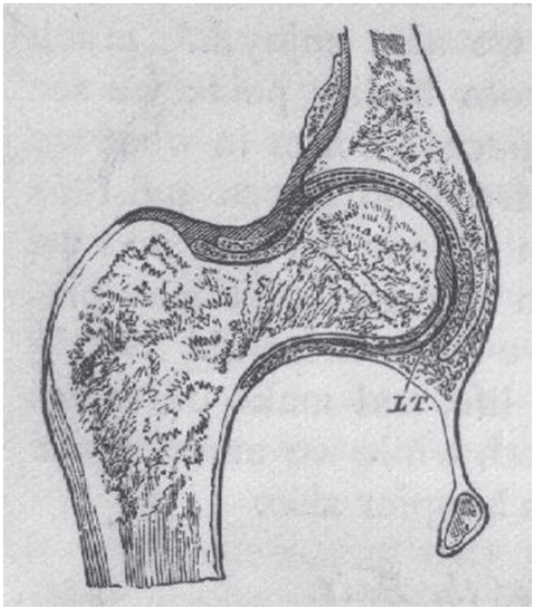
Joints

Overall view of a joint

- A joint is formed where two or more bones come in close contact in the body and are attached to each other by ligaments.
- Joints allow our bodies to move; in many ways.
- Joints are classified into different types according to their movement.
- Immovable joints do not move e.g. the plates of the skull.
- Partially movable or cartilaginous joints move a little and are linked by cartilage, as in the spine.
  - Freely movable, or synovial joints are filled with synovial fluid, which acts as a lubricant to help the joints move easily; i.e. joints that can move in many directions. Hips, shoulders, elbows, knees, wrists, and ankles are all freely movable.
- There are three types of freely movable or synovial joints:
  a. Hinge joints allow movement in one direction, as seen in the knees and elbows
  b. Pivot joints allow a rotating or twisting motion, like that of the head moving from side to side
  c. Ball-and-socket joints allow the greatest freedom of movement. The hips and shoulders have this type of joint, in which the round end of a long bone fits into the hollow of another bone.

Diagram 3: A hinge joint (the knee)

Diagram 4: A ball and socket joint



Other types of joints

- Gliding joints:
  - Allow for gliding movements between flat surfaces as the surfaces slide over one another
  - Only a limited amount of movement is allowed such as the joints between the carpal bones and the joints between the tarsal bones.

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- Pivot joints:
  - The end of one bone rotates round the axis of another bone, such as the end of the radius rotating around the ulna as the palm of the hand is turned inwards or outwards.
- Compound:
  - These joints are made up of several joints between a number of different bones
  - The bones articulate with one another in different ways, allowing for a variety of movements, such as the set of joints which operate the movement of the skull on the vertebral column, allowing for the nodding movement of the head as well as rotating the head around and allowing the head to turn from side to side.

Cartilage

- The most obvious use of cartilage in the body is as a 'shock absorber'.
- Cartilage is used for cushioning and relieving the stress associated with the weight you put on your knee and other joints.
- Cartilage is rubbery as well as being exceptionally elastic.

Synovial fluid

- The synovial membrane is the inner membrane of tissue of the joint that secrets synovial fluid.
- Synovial fluid acts to lubricate the joint.
- Synovial fluid nourishes and lubricates the cartilage at the end of each bone.

Body mechanics

Principles of movement

- There is a coordinated effort of musculoskeletal and nervous systems to maintain:
  - Balance
  - Posture
  - Body alignment: lifting, bending, moving and performing activities of daily living (ADLs).
- Proper body mechanics is very important to the safety and wellbeing of the older person because it:
  - Reduces risk of injury to musculoskeletal system
  - Facilitates ease of body movement
  - Allows more efficient use of energy.

Principles of biomechanics

- Muscles are always in a mild state of contraction.
- The point at which the body's mass is concentrated is the centre of gravity.
- The closer a force is applied to the centre of gravity the more effective and stable that force is.
- The greater the base of support, the more stable the body is.
- All body systems work more efficiently with some form of movement.

Normal age-related changes

Multiple changes occur in the musculoskeletal system with ageing.

Bone

Nearly 90 per cent of adult skeletal mass is formed by the end of the teenage years. Peak bone mass is reached by the age of 30. Around middle age, bone mass begins to gradually decline as age-related change disrupts the balance between the osteoblasts (cells that produce bone) and the osteoclasts (cells that absorb bone). As the growth of bone slows it begins to thin and become more porous. Women have a more rapid rate of bone loss than men, with the most rapid losses occurring in the five years following menopause. Eventually, the bones have the strength of an egg-shell and even minor trauma can cause the bone to collapse and fracture.

Posture

By the age of 80, most people will lose an average of about 5 cm in height. The primary factors contributing to this reduction in height include compression of vertebrae and changes in posture, such as kyphosis (curvature of the thoracic spine; 'hunchback').

Kyphosis is generally a normal state of ageing; however, the extent of the curvature and the effect of it on the older person's physical function and comfort and the ability to be self-caring may mean it is pathology.

Muscle

As people age, our muscles generally decrease in strength, endurance, size and weight. Typically, we lose about 23 per cent of our muscle mass by age 80 as both the number and size of muscle fibres decrease.

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Increased inactivity, diminished neuron stimulation and nutritional deficiencies contribute to loss of muscle strength.

Much of this decrease in muscle mass can be prevented by maintaining physical fitness. Muscle mass decreases and body fat increases with age. Women tend to have more body fat than men and body fat continues to increase until about the 70s; men are similar except that the body fat stops around the age of 50. The body fat tends to redistribute away from the peripheries to the trunk and hips with the result that bony prominences in the peripheries become more prominent and at greater risk for pressure areas.

The implications of decreased muscle tone and strength:

- Atrophy is a decrease in the size of a muscle with resultant loss of muscle mass and strength. Atrophy of muscle density, muscle weakness and decreased muscle functional activity is associated with an increased risk of hospitalisation
- Flaccidity is less than normal tone of the muscle
- Spasticity is greater than normal tone
- Lack of coordination, such as ataxia. Ataxia is a loss of the ability to control and coordinate voluntary muscle movements and can affect speech, walking and fine motor movement
- Altered gait, which can lead to less stable base of support for walking and balance
- Pain
- Activity intolerance, which means the older person can't sustain activity to the degree required by the activity.

Common musculoskeletal problems associated with ageing

Osteoporosis

Osteoporosis is basically when bone resorption occurs more rapidly than bone production, which results in a loss of bone density. It is more common in females after menopause, but occurs in men as well.

Falls

The most consistently identified risk factors associated with falls in older people are gait instability, confusion, a history of falls, urinary incontinence or frequency, and medications, such as sedatives.

Fractures

A fracture is a traumatic injury to a bone in which the continuity of the bone tissue is broken. The six Ps of a fracture are:

- Pain
- Pallor
- Paresthesia
- Paralysis
- Pulse
- Poikilothermia (coldness) – inability to maintain temperature (often related to blood supply).

Osteoarthritis

Osteoarthritis is a degenerative disease of the joint where cartilage is gradually destroyed and bony spurs and cysts form along the edges of the joints. It tends to occur in weight-bearing joints and is more common in men than women. It is caused by overload on the joints or is secondary to trauma, such as joint injury. Common signs and symptoms are distortion of the joint's appearance, pain, crepitus (a grinding feeling on movement caused by bone upon bone), limited range of movement (ROM) and swelling.

Immobility

A general principle for musculoskeletal wellbeing is 'use it or lose it'. Inactivity or immobility affect a person's total physical and psychosocial wellbeing.

Causes of immobility in the older person

- Physical factors such as pain, bone fracture or joint degeneration
- Psychosocial factors such as lack of socialisation opportunities
- Environmental factors
- Neurological, cognitive/perceptual factors
- Pharmacological factors including the use of medication that causes sedation.

Effects of immobility on the musculoskeletal system

The effects of immobility on the musculoskeletal system include:

- Loss of bone density through demineralisation. It is well-documented and reported that calcium is lost from bone when there are not enough weight-bearing activities
- Loss of joint movement through improper positioning or fixation (ankylosis)
- Contracture (shortened muscle) formation as inactive muscle tissue is replaced with inflexible fibrous tissue.

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Effects of immobility on other body systems

The effects of immobility on other body systems include:

Gastrointestinal

- Metabolism of carbohydrates, fats and proteins is altered causing gastrointestinal disturbances such as decreased appetite and slowing of peristalsis. This condition places the older person at risk of developing constipation
- Anorexia (loss of appetite) causes a deficiency in calories and protein resulting in weight loss, muscle atrophy, weakness
- Calcium resorption from bones is the release of calcium into the circulation

Increased cardiac workload

- Normal muscle activity promotes circulation through the squeezing action. The heart is a muscle and inactivity results in deconditioning and loss of efficiency, which then means the heart muscle has to work harder than usual to respond to circulatory demands
- A decrease in muscle action in the peripheries means circulation becomes sluggish and there is an increased risk for thrombus and embolism formation
- Blood pools in the lower extremities; when standing, a person experiences orthostatic hypotension (the decreased ability to maintain systemic blood pressure when changing from supine to upright position). This is because chronic over-dilation of vessels means they are slower to adapt and to maintain blood pressure in response to changes in body position. Hypotension causes dizziness and fainting, so the older person is at greater risk of falls. Normal age-related changes and conditions such as Parkinson's disease and diabetes make the older person more at risk of orthostatic hypotension so immobility compounds the problem. Dehydration and some antidepressants (e.g. Amitryptilline) and antihypertensive medications, such as beta blockers (e.g. Metoprolol) also cause orthostatic hypotension

Decreased lung expansion

- Breathing becomes slow and shallow as the need for deep breathing is decreased due to less demand. If this continues for a prolonged time, secretions can pool and the older person loses the ability to cough effectively so they are at risk of infection and hypostatic pneumonia. Hypercapnia can result due to increased carbon dioxide as a result of poor gas exchange. Atelectasis (collapse of the alveoli) also contributes to ineffective gas exchange

Urinary system

- The positioning of the older immobile person in the supine position for long periods of time can result in residual urine and the risk of infection. This contributes to the development of urinary calculi (stones) and obstruction of urine flow. The ineffective emptying of the bladder leads to bladder distention and incontinence

Psychosocial effects

The response by the older person to partially or fully losing their mobility will be individual, but may include:

- Anger and frustration at their loss of independence
- Fear
- Anxiety about how to cope and who will help them
- Sleep disturbances due to less activity, but also worry
- Disorientation and confusion
- Social isolation
- Depression
- Fostering learnt dependency, with the result that the person does not take responsibility for any activity or self-care within their range of capability.

Preparation for assessment

Equipment:

- Tendon hammer (plessor), (NB. This is described in Module 7 Cognitive and Perceptual assessment module).

Environment:

- Quiet surroundings
- Good lighting
- Bed at appropriate height – eye to eye
- Remove clutter and obstacles
- Space for movement.

Older person:

- Privacy and comfort
- Safety
- Explain that you will need to visualise, palpate and move their joints
- Position will vary from sitting, standing, walking, bending, stretching
- Information and consent.

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Clinician:

- Knowledge of anatomy and physiology, anatomical landmarks
- Knowledge of normal ranges for findings
- Sequence assessment, head to toe
- Have appropriate documentation
- Wash your hands.

Subjective data

The purpose of the subjective functional health status assessment is to determine risk factors for or the presence and extent of musculoskeletal disease and the impact of this the older person's ability to be self-caring and carry out their ADLs.

Review of the older person's activities

Areas for questioning about the musculoskeletal system

The client's perceptions of their general capabilities:

- When performing their ADLs
  - Showering
  - Dressing
  - Walking
  - Running
  - Lifting
  - Carrying
- Leisure and recreation
  - How do they like to spend their leisure or recreation time?
  - Are they able to participate in the things they want to?
  - Does their level of fitness enable them to do the things they want?
- Exercise Patterns
  - Frequency
    - How often do they exercise?
  - Do they have an exercise routine?
  - Type
    - What types of exercise do they do?
- Do they include weight-bearing exercise as part of their routine?
  - Importance to the person
    - How important is it for them to be able to exercise?
  - Perceived time to undertake
    - How long do they usually exercise for?
- Menopause
  - Age of onset (length of time can have a bearing on osteoporotic changes in bone)
- Alcohol, cigarette, caffeine intake have all been identified as impacting upon bone density and increasing the risk for fracture
  - Caffeine affects calcium and vitamin D absorption in the gut, but it is unlikely to really have an effect unless it was consumed in large amounts
  - Smoking alters the metabolism of hormones such as oestrogen and the absorption of vitamin D resulting in increased bone resorption and density. Smoking affects the bone mineral content of the trabeculae. The effect may decrease with age
  - Alcohol sedates the bone marrow and results in decreased red and white blood cell production and weakened bones. This also puts a person at risk for developing anaemia and infection
- Nutrition
  - Recent weight gain or weight loss. Obesity impacts on weight-bearing joints through overload and weight loss can mean nutritional deficiencies in minerals needed for bone construction and strength
- Medications
  - Supplements
  - Over-the-counter
  - Prescribed.

Subjective complaints (symptoms)

- Low energy levels
  - Weakness
  - Reduction in endurance
- Joints – joint pain or loss of function is the most common musculoskeletal complaint in the older person
  - Character
    - Ask the person to describe the change, such as stiffness, change in size (atrophy or swelling), decrease in ROM
    - Note any clicking
    - Ask the person if they have any difficulty in movement, such as locking or giving way

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- Limitation of movement and how this interferes with the daily activities the older person performs
- Change in shape of the joint
- Change in appearance, such as redness or shiny skin over the joint
- Timing
  - When is the problem most noticeable; for example, first thing in the morning or after they go for a walk?
  - Are there other factors; for example, changes in the weather?
  - Did the problem start suddenly or has it occurred gradually?
- Source
  - Is it a result of injury or, for example, the wear and tear of ageing? You want to try to establish the cause of the problem as interventions can be targeted to the cause
- Other signs or symptoms, such as heat and swelling
- What is their perception of how it affects them?
  - Have they noticed changes to the affected areas and to their ability to carry out usual activities? For example, has their walking changed?
- What has the person done to treat the pain? For example, rest, heat or cryotherapy, structural supports (splints or braces)? Ask for a description of strategies that have been used to deal with the problem
- What medications and supplements does the person take? Are they prescription or over-the-counter; e.g. non-steroidal anti-inflammatories, glucosamine or calcium?

- Injury
  - When did the person injure themselves?
  - What were they doing at the time of the injury?
  - Frequency of injuries. In older people an increase in the number of minor injuries may indicate a more serious problem, such as with vision, mobility, and neurological function
  - Was there a particular sensation when they injured themselves; e.g. a popping noise, tearing, joint locking or displacement?
  - Severity of pain. Ask the person to rate the pain out of 10 and describe the characteristics of the pain. Ask them to identify what makes it worse (aggravating factors) and what makes it better (ameliorating factors)
  - Ask the person to identify any management they have tried to alleviate pain

- Pain Assessment (COLDSPA)
  - **C**haracter
    - Sharp pain, an ache, burning or tingling
  - **O**nset
    - When did the problem start?
  - **L**ocation – joint, muscle, bone
    - Is it on one side or both sides of the body?
  - **D**uration
    - How long have they had it for?
    - How long does the problem last for? For example, does it improve once they get moving in the morning, or after they have a rest?
  - **S**everity
    - How would they rate their pain out of 10?
  - **P**attern
    - Is it localised or does it move to other areas as well?
    - What makes it better or worse?
  - **A**ssociated factors
    - Heat, swelling, numbness, limited movement
- Muscle
  - Character
    - Weakness or fatigue
    - Paralysis, spasm
    - Wasting or swelling
    - Difficulty in movement
  - Limitation of movement and how this interferes with the daily activities the older person performs
  - Timing
    - Does the pain or cramping occur at a particular time of day? With certain activities or specific movements; e.g. when they walk?
    - Are there other factors; e.g. changes in the weather ?
  - Is the weakness in both limbs or just on one side?
  - What have they done to treat it; e.g. ice or heat, massage?
  - What medications do they take? Are they prescription or over-the-counter?

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- History
  - Family history
    - Osteoporosis, arthritis or gout
    - Congenital deformities
    - Genetic disorders
  - Medical history
    - Surgery, such as joint replacements or fusions
    - Medical problems, such as injuries that cause chronic pain or altered musculoskeletal function and appearance, such as polio
    - Congenital abnormalities or conditions, such as spasticity or spina bifida
    - Any previous risk screening, such as bone density tests
    - Immunizations' status, such as tetanus, polio.

Objective data

Assessment techniques

- Observation
- Palpation

Observe:

- General appearance:
  - Alertness
  - Lethargy
  - Hygiene
  - Appearance (clothing)
  - Body
  - Response to directions from the examiner
- General body movements:
  - Effort required for movement
  - Assess gait and posture
    - Gait - can be tested also with neurological system as part of cerebellar function
    - Stride - there is about 38cm from heel to heel
  - Rhythm of their walk
  - Posture
    - Spinal curvature
      - Observe the person from the side
      - Normal posture
        - Body erect
        - The head upright
        - Thoracic spine is convex
        - Lumbar spine is concave
    - Balance
- Assess this by asking the person to walk away from you for about 5 metres, turn and come back to where they started:
  - Normal gait is smooth and effortless; the opposite arm to the leg swings freely at the sides
  - Turning is coordinated and easy – gait is balanced with erect posture and on turning, face and head turns before body.

Diagram 5 : Lordosis

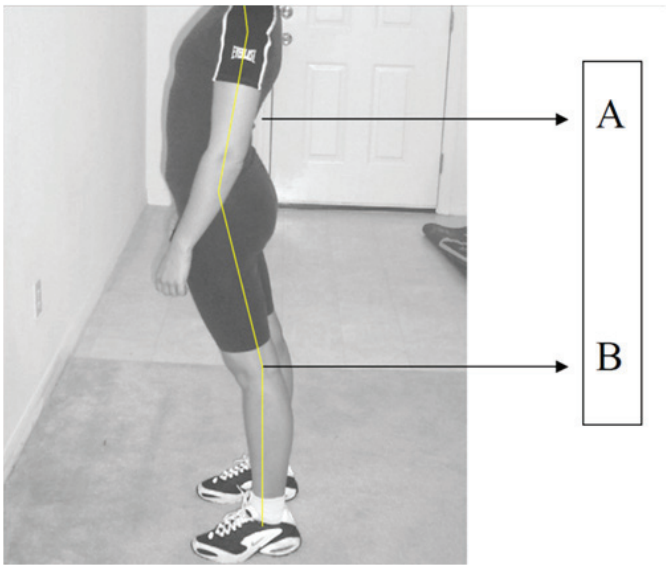

Diagram 6 : Kyphosis

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Diagram 7 : Scoliosis

Technique

Musculoskeletal assessment involves moving through the major body areas and muscle groups; inspecting, palpating and testing ROM and strength at each point. Examine the following areas:

- Neck
- Head
- Temporo-mandibular joint (TMJ)
- Spine
- Shoulders
- Elbows
- Wrists
- Fingers
- Hips
- Knees
- Ankles
- Toes.

Inspection

Look at the anterior (front), lateral (side) and posterior (back) surfaces of the body and the size and contour of all the joints.

Assess:

- Skin – colour
- Muscles
- Limbs
  - Size and shape
  - Symmetry – length, circumference, position and number of skin folds
  - Alignment
  - Any abnormalities or deformity, such as atrophy, wasting, contracture.

Palpation

- Palpate all joints upper and lower for:
  - Crepitus – this is a crackling or grinding sound and/or sensation, which is felt when two bony surfaces are rubbing together
  - Heat
  - Swelling
  - Pain
  - Muscle tone around joints should be firm without 'boggy' areas or spasticity (increased muscle tone)
- Report any pain or tenderness on palpation
- Place the palm of your hand over joint during ROM assessment to detect crepitus
- Muscle mass
- Muscle resistance and strength.

To test muscle strength, gradual pressure (or resistance) is applied against the normal action of the muscle or joint. The pressure is usually applied to the distal end (end furthest from the body). For example, the elbow flexes towards and extends away from the body at the elbow joint. To test, the examiner would apply pressure just above the wrist to stop this motion. The person should be able to resist the pressure and still carry out the flexion and extension.

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Table 1: Range of movement

Muscle strength and tone – if muscle strength is less than 3 then disability is present	
0	No evidence of movement (paralysis)
1	Barely detectable muscle contraction
2	Complete ROM or active body part movement with gravity eliminated (poor ROM)
3	Complete ROM or active movement against gravity, but not against resistance
4	Complete ROM or active movement against gravity and some resistance, but weak
5	Complete ROM or active movement against gravity and full resistance (normal)

Chapter 15: Musculoskeletal system (2012). In Forbes, H., & Watt, E. (Eds.), *Jarvis's physical examination & health assessment [Australian & New Zealand edition (pp. 325-388)]*. New South Wales: Elsevier Australia.

Table 2: Terminology for ROM

Movement	Description
Flexion	Bending a limb; e.g. the elbow
Extension	Straightening a limb
Abduction	Moving a limb away from the midline of the body; abduct = to take away
Adduction	Moving a limb towards the midline of the body; adduct = to add
Pronation	Palm down
Supination	Palm up
Circumduction	Moving in a circle around the shoulder
Inversion	Sole of the foot turns in with big toe pointing up
Eversion	Sole of foot turns out with big toe pointing down
Rotation	Moving the head – looking left, right and straight ahead
Protraction	Sticking chin forward and parallel to ground
Retraction	Pulling chin back and parallel to ground
Elevation	Raising a body part
Depression	Lowering a body part

Chapter 15: Musculoskeletal system (2012). In Forbes, H., & Watt, E. (Eds.), *Jarvis's physical examination & health assessment [Australian & New Zealand edition (pp. 325-388)]*. New South Wales: Elsevier Australia.

Module 3:
Musculoskeletal assessment

Assessment of ROM

- Start at the head and work your way down:
  - Get the older person to copy movements that you make
  - Then get them to repeat the movements while your hand is placed over the joint that they are moving (palpation of the joint)
  - Then repeat the ROM against resistance to ascertain strength and tone (you push against the person's movement)
  - Make sure you support the limb being assessed and that the person is well-supported to avoid falls.

Active and passive ROM

The terms active and passive relate to whether the clinician moves the joint (passive) or the older person moves the joint themselves (active). Ideally when you test ROM and strength, it is with active movement, but if the subjective history or inspection identifies a possible area of pain or a problem, then you should support and anchor the joint (so you control the movement) and gently move it through the ranges. You need to observe and question the person's response to movement.

Table 3: Assessment of ROM of main body areas

(Please refer to further diagrams provided with workshop handouts and web links)

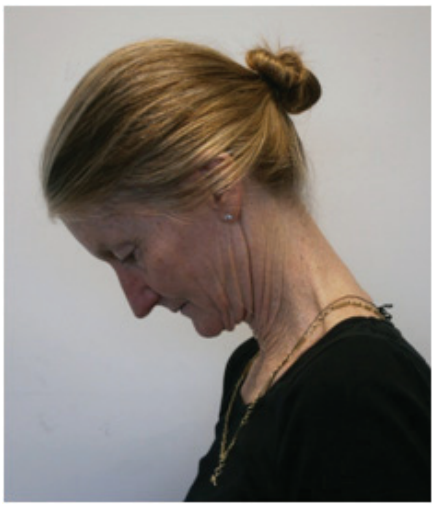
Temperomandibular joint (TMJ)	
Position	Person seated
Examination	*Palpate* TMJ and masseter muscles Start distally and work forward Mouth open and closed *Assess* ROM You can test cranial nerve V (trigeminal) as well
ROM	Ask the person to open their mouth *Normal range* = a distance of 3–6 cm between the incisors Protrude (stick out, push forward) lower jaw and move side to side *Normal range* = 1–2 cm sideways movement Stick out lower jaw *Normal range* = no deviation from mid-line

Module 3:
Musculoskeletal assessment

Diagram 8: ROM of the neck (A, Flexion. B, Lateral bending. C, Rotation.)

Neck joint	
Position	Person seated
Examination	*Assess* ROM *Test strength* (apply resistance try to push in opposite direction) as person moves through the ranges to test cranial nerve XI (spinal); e.g., shrug the shoulders (shoulder girdle)
ROM	Flexion (chin to chest) *Normal range* = 45° Lateral (ear to shoulder each side) *Normal range* = 40° Extension (chin to roof) *Normal range* = 55° Rotation (chin to shoulder each side) *Normal range* = 70°

A



B

C

Module 3:
Musculoskeletal assessment

Diagram 9: ROM of the shoulder (A, Hyperextension. B, Abduction. C, Internal rotation. D, External rotation.)

Shoulder joint	
Position	Person standing
Examination	*Observe* *Palpate* *Assess* ROM *Assess muscle strength* by person holding arms out to side at 90° and you apply a downward pressure and ask them to attempt to resist
ROM	Flexion (arms above head next to ears) *Normal range* = parallel to floor up to 180° Hyper extension (take arms straight out behind) *Normal range* = up to 50° Abduction (away from the body) *Normal range* = 180° Adduction (toward the body) *Normal range* = 50° Internal rotation - touch back pocket on opposite side *Normal range* = 90° External rotation – touch back of neck *Normal range* = 90° Circumduction – arms extend and make circle with full arm

A

B

C

D

Module 3:
Musculoskeletal assessment

Diagram 10: ROM of the elbow (A, Flexion. B, Supination. C, Pronation.)

Elbow Joint	
Position	Person standing
Examination	*Observe* – hollows either side of joint *Palpate* (support arm at 70°) move around joint *Assess* ROM *Strength* support elbow with one hand and have person flex while you apply resistance at wrist
ROM	Flexion (bend up toward body) *Normal range* = 160° Extension (bend down away from body) *Normal range* = 0°

A

B

C

Module 3:
Musculoskeletal assessment

Forearm joint	
Position	Person seated
Examination	*Observe* movement *Palpate* wrist: is it relaxed and aligned *Assess* ROM including rotation
ROM	Supination (palm up) *Normal range* = 90° Pronation (palm down) *Normal range* = 90°

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Musculoskeletal assessment

Diagram 11: ROM of the wrist (A, Flexion. B, Extension. C, Abduction.)

Wrist joint	
Position	Person seated
Examination	*Inspect* *Assess* ROM *Assess strength* with arm lying supine (palm up), hold arm below elbow and apply pressure to palm ask person to flex wrist up.
ROM	Flexion (point fingers to ground) *Normal range* = 90° Extension (Hyper [point fingers up and back toward body]) *Normal range* = 70° Adduction (radial flexion [hand flat, move toward body using wrist]) *Normal range* = 20° Abduction (ulnar flexion [hand flat, move away from body using wrist]) *Normal range* = 55°

A

B

C

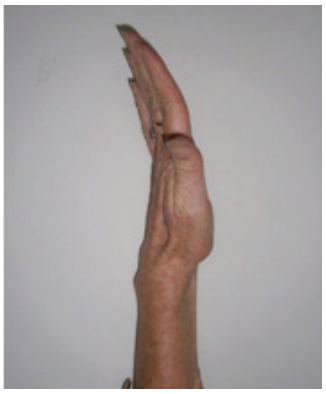
Module 3:
Musculoskeletal assessment

Diagram 12: ROM of the fingers and thumb (A, Flexion. B, Hyperextension. C, Abduction. D, Opposition to little finger.)

Fingers and thumb joints	
Position	Person seated
Examination	*Inspect* *Palpate* each joint and finger *Assess* ROM *Strength* – ask person to grip your hands as tight as they can. Test separately and together
ROM	Flexion *Normal range* = 90° Extension (hyper) *Normal range* = 30° Abduction *Normal range* = 55° Adduction *Normal range* = 20° Make a fist Opposition – touch thumb to each finger and base of little finger

A

B



C

D

Module 3:
Musculoskeletal assessment

Diagram 13: ROM of the hip (A, Flexion. B, Internal rotation. C, Abduction.)

Hip joint	
Position	Person lying on back and standing for hyperextension
Examination	*Inspect* *Palpate* *Assess* ROM
ROM	Flexion (raise leg knee straight) *Normal range* = 90° Hyperextension (leg behind) *Normal range* = 15° Internal rotation (knee bent) *Normal range* = 40° External rotation (knee bent) *Normal range* = 45° Abduction (leg straight, swing leg) *Normal range* = 45° Adduction (leg straight, swing leg) *Normal range* = 30°

A

B

C

Module 3:
Musculoskeletal assessment

Diagram 14: Flexion of the knee

Knee joint	
Position	Person seated and/or lying Person standing
Examination	*Inspect* quadriceps for atrophy *Palpation* *Assess* ROM
ROM	Flexion *Normal range* = (130°) Extension *Normal range* = (0°)

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Musculoskeletal assessment

Diagram 15: ROM of the ankle and toes (A, Dorsal flexion. B, Plantar flexion. C, Inversion. D, Eversion. E, Flexion of toes.)

Ankle and toe joints	
Position	Person seated and/or lying
Examination	*Inspect* *Palpation* *Assess* ROM *Strength* dorsi and plantar flexion against resistance
ROM	Dorsal flexion (point toes back toward nose) *Normal range* = 20° Plantar flexion (point toes to floor) *Normal range* = 45° Inversion (sole in, big toe off bed) *Normal range* = 30° Eversion (sole out, big toe on bed) *Normal range* = 20° Extension (toes fully out) Flexion (toes curled)

A

B

C

D

E

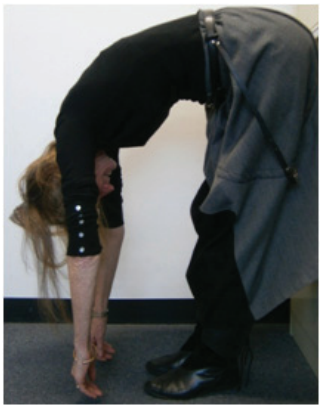
Module 3:
Musculoskeletal assessment

Diagram 16: ROM of the spine (A, Flexion. B, Extension. C, Lateral bending. D, Rotation.)

Spinal joints	
Position	Person standing
Examination	*Inspect* shape of spine *Palpate* vertebra *Assess* ROM
ROM	Flexion (touch floor, knees straight) *Normal range* = 90° Extension (bend at waist arms parallel with floor) *Normal range* = 30° Lateral (side) bending (feet together) *Normal range* = 35° Rotation (turn shoulder as far as can go to each side) *Normal range* = 30°

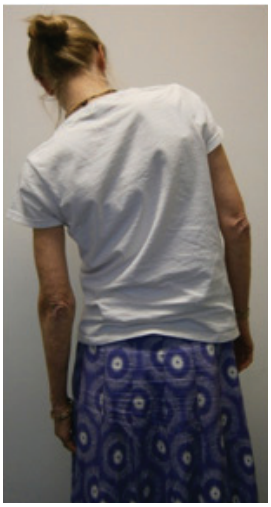
Chapter 15: Musculoskeletal system (2012). In Forbes, H., & Watt, E. (Eds.), *Jarvis's physical examination & health assessment [Australian & New Zealand edition (pp. 325-388)]*. New South Wales: Elsevier Australia.

A

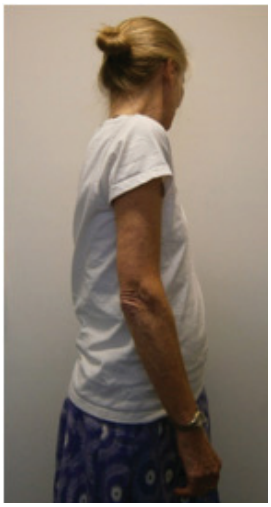


B

C



D



Module 3:
Musculoskeletal assessment

For a diagram of ROM of the spine see http://www.brianmac.co.uk/musrom.htm

Functional musculoskeletal assessment for the older person involves assessing the person's ability to meet their activities of daily living.

Table 4: Functional musculoskeletal assessment of the older person

Ask the person to:

Action	Common indications of ageing and muscle weakness
Walk with shoes on	Wider base of support; shuffling
Pick up an object from the floor	Bends at waist rather than with legs; uses support, such as furniture, for balance and to help stand up
Stand up from a sitting position	Has a couple of tries to build momentum; upper trunk leans forward and then straightens once they are up; uses arms to push off from chair arms; has feet positioned widely as base of support
Move from a lying to a sitting position	Rolls to edge of bed and then moves legs to floor and pushes upper body off the bed with arms
Put on clothes	Dresses weaker side first. Sits to put stocking/pants on and then stands to pull up. Elevates foot to tie shoes to decrease spinal flexion
Comb hair	Problems with ROM of elbow, forearm and wrist
Write	Problems with manual dexterity and finger-thumb opposition
Walk up and down steps	Up – leads with stronger leg and uses hand rail for support and to pull self up Down – leads with weaker limb, watches feet and may hold rail with both hands.

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Module 3:
Musculoskeletal assessment

Example

Miss K, who has mild dementia, presents with increasing confusion and restlessness over a three-day period, particularly during the night after the lights are turned off. She calls out frequently and cries a lot. She cannot provide a coherent response to questions about what the matter might be, but she appears to be in some discomfort. You go in to help her settle for the night and perform an assessment.

Her health care records reveal that she has been receiving Panadol x 2 6/24 with little effect and that the GP is coming to see her the following morning. Routine blood tests have been ordered for the following day. There has been no obvious trigger for her current state. She has been taking her diet as usual. One entry records that she slipped and partially fell against the side of the bath about five days ago, but as there was no obvious injury, no further action, other than vital signs and observation, was taken. She was taken back to her room in a wheel chair after the incident. She has been reluctant to ambulate with some assistance, but that is not so unusual, and has walked with encouragement.

She moved into residential care five months ago because her family and the district nurse believed she was not coping. She was forgetting to turn off the gas and put the electric kettle on the stove over a flame and caused a small fire in her kitchen. They described a woman who was normally immaculately groomed, but this changed and she started wearing odd articles of clothing, such as her 'nightie' over a skirt. She would go to the shops and forget to buy any food or household supplies.

Her medical history reveals loss of short-term memory, osteoarthritis and hypertension, which is treated with Metoprolol.

General inspection:

- Pallor
- Grimace
- Groaning particularly with movement
- Vital signs: P 98 /minute – weak and thready; BP 135/87; R. 26/minute; T 36.4°C.

You note when you put your hand under her right leg to help her move in bed that her vocalisations increase as does her facial expression.

You examine her right leg.

General observation

- Shorter than left leg
- Alignment – the right leg has an external rotation.

Focused joint assessment

Ankle and Knee – no abnormalities detected

Hip

- Swelling over greater trochanteric area
- Cool
- Pain – using the Abbey Pain Scale you calculate her pain as moderate (12/13) at rest and a severe (> 14) with movement
- Gentle ROM shows limited range, particularly with internal rotation.

Activity

Using this data:

1. Cluster the data into related groups; for example, data that relate to movement
2. Examine the grouped data and list your hypothesis about actual or potential musculoskeletal problems (and others) derived from each grouping
3. Can you confirm any actual problems or a very high risk of developing a problem? That is, diagnose a problem, because you have enough information to say it exists or the person is very likely to develop it
4. List your diagnoses
5. Identify what further data you would need to obtain in order to make any further diagnoses.

Module 3:
Musculoskeletal assessment

Resources

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Module 3:
Musculoskeletal assessment

Image reference

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Diagram 8: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the neck. **A,** Flexion. **B,** Lateral bending. **C,** Rotation. [Photo]: Melbourne, Australia.

Diagram 9: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the shoulder. **A,** Hyperextension. **B,** Abduction. **C,** Inward rotation. **D,** Outward rotation. [Photo]: Melbourne, Australia.

Diagram 10: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the elbow. **A,** Flexion. **B,** Supination. **C,** Pronation. [Photo]: Melbourne, Australia.

Diagram 11: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the wrist. **A,** Flexion. **B,** Extension. **C,** Abduction. [Photo]: Melbourne, Australia.

Diagram 12: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the fingers and thumb. **A,** Flexion. **B,** Hyperextension. **C,** Abduction. **D,** Opposition to little finger. [Photo]: Melbourne, Australia.

Diagram 13: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the hip. **A,** Flexion. **B,** Internal rotation. **C,** Abduction. [Photo]: Melbourne, Australia.

Diagram 14: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). Flexion of the knee [Photo]: Melbourne, Australia.

Diagram 15: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the ankle and toes. **A,** Dorsal flexion. **B,** Plantar flexion. **C,** Inversion. **D,** Eversion. **E,** Flexion of toes. [Photo]: Melbourne, Australia.

Diagram 16: Australian Centre for Evidence Based Aged Care, La Trobe University (2013). ROM of the spine. **A,** Flexion. **B,** Extension. **C,** Lateral bending. **D,** Rotation. [Photo]: Melbourne, Australia.