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The prevalence of shoulder pain and disability among the desktop workers with shoulder pain and disability index score in Sana'a, Yemen.

-A cross-sectional study

A graduation project submitted to the faculty of medicine, at Azal University for Human Development in partial fulfillment of the requirements for the degree of Bachelor degree of Science in Physical therapy.

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Certificate

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DEDICATION

We would like to express our special gratitude to The Almighty God for his grateful mercy, grace to do this project and then to our parents who kept suitable conditions for us and support us to finish our research. In addition, we will not forget our friends who support us while we were doing this research and a special thanks to our classmates and Dr. Immanuel Noble.

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SPADI: Shoulder pain and disability index, C: Cervical, T: Thoracic.

SP: Shoulder pain, EMG: Electromyography.

NRS: numerical rating scale.

ADLs: Activity daily livings, ROM: Range of motion.

ICC: intraclass correlation coefficient.

SPSS: Statistical package for the social sciences.

ABSTRACT

Introduction: Shoulder joint is an important part to perform everyday life activities and important for a bread winner in this generation as they have to use computers a lot. Now a days people work in computer for a long time in their work and also in the house. The work related problems are increasing and people suffer with repetitive stress disorders. There are many countries doing a lot of changes to help their employees. But developing countries don't know the method to follow ergonomics or due to lack of information about the incidence of work related issues. And in Yemen there were no such measures happened and so we decided to find the incidence of shoulder problems in desktop workers.

Method: In this cross-sectional study, 119 samples were participants, they were 54 males and 65 females they were screened for inclusion and exclusion criteria and SPADI scale was used to identify the pain and disability score of the shoulder. The procedure was explained for every participants and the data was collected. The statistics was analyzed with SPSS package.

Results: The differences between males and females for total pain score, total disability score and total SPADI percentage using the Independent Samples Test shows that there are differences between males and females for total pain score, total disability score and total SPADI percentage and results were there are statistically significant differences at level less than 0.05. These differences were in favor of the female gender. Secondly about the differences between age, height, working hours and year of experience for total pain score, total disability score and total SPADI percentage using Anova Test and results were not statistically significant differences at a lesson level less than 0.05. The reason maybe, the distribution of samples were concentrated more while dividing the samples in group and not equally distributed.

Conclusion & Discussion: The study is telling that the gender difference makes impact in shoulder comparing to other factors.

Key words: Shoulder pain, Office workers, Sitting posture, SPADI Scale

INTRODUCTION

AND

LITERATURE REVIEW

Introduction and literature review

INTRODUCTION:

In day to day life of human beings they need to perform a lot of activities of daily living. For any daily activities we need to use all the four limbs and sometimes both the lower limbs or upper limbs. When it comes to upper limbs shoulder joint is the junction to perform activities. For example, combing hair, changing dress etc. when we divide the lifestyle, it will be in two aspects one will be daily chores as everyone and another will be bread winner aspect. Income is important in life to have a good quality of life. So in this modern era, we are using computers in different format for the work and in this decade it becomes a communication tool too due to social media. This makes a person to use the desktop every day and it becomes a part of life. When it comes in the aspect of work we will use desktop for a longer time ranging from 4 to 8 hours as minimum. This will lead to continuous usage of shoulder for long hours. But practically when we use the shoulder in daily activities, it will be maximum 10 to 20 times lifting it overhead when there is a need. But in work it will be constant usage for prolonged hours and 70% of days in a year. This will lead to accumulation of stress in the shoulder joint which can lead pain and disability. There are many studies done in different countries with many aspects for shoulder joint problems and disability chances but here there are no studies done regarding the prevalence of shoulder problems among desktop workers and no proper ergonomics being followed. So we took this as a chance to find the prevalence of shoulder pain and disability among desktop workers.

Ergonomics:

It is the study of the interaction between people and machines and the actors that affect the interaction fits purpose is to improve the performance of systems by improving human machine interaction.
This can be done by ‘designing-in’ a better interface or by ‘designing-out’ factors in the work environment, in the task or in the organization of work that degrade human–machine performance. The name ‘ergonomics’ comes from the Greek words ‘ergon’, which means work and ‘nomos’ which means law.

The focus of ergonomics:

The focus is on the interaction between the person and the machine and the design of the interface between the two (Figure 1). Every time we use a tool or a machine we interact with it via an interface (a handle, a steering wheel, a computer keyboard and mouse, etc.). We get feedback via an interface (the dashboard instrumentation in a car, the computer screen, etc.) The way this interface is designed determines how easily and safely we can use the machine.

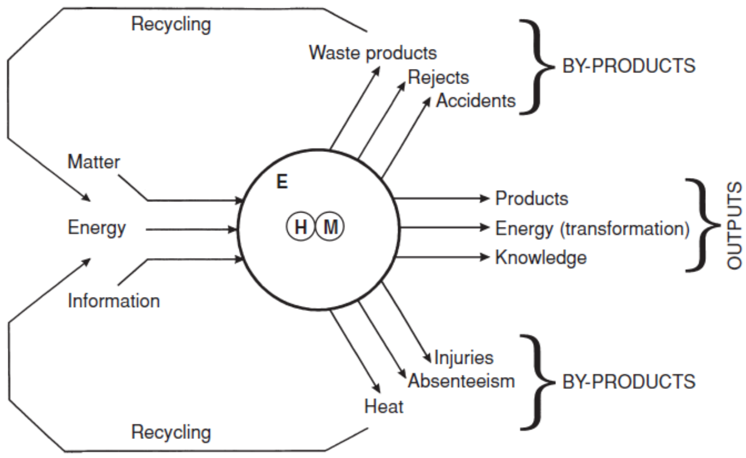


Figure 1.1 A simple work system. People interact with machines to turn inputs into outputs. System capacity refers to amount of input that can be processed over time. Productivity refers to the ratio of outputs to inputs. Efficient systems minimise by-products of all kinds (E = local environment, M = machine, H = human operator).

Figure (1)

Human–machine systems:

A system is a set of elements, the relations between these elements and the boundary around them. Most systems consist of people and machines and perform a function to produce some form of output. Inputs are received in the form of matter, energy. For ergonomics, integrated into it at the design stage. Human requirements are therefore system requirements rather than secondary considerations and can be stated in general terms.

as requirements for:

• Equipment that is usable and safe
• Tasks that are compatible with people's expectations, limitations and training
• An environment that is comfortable and appropriate for the task
• A system of work organization that recognizes people's social and economic needs.

Application of ergonomics:

The purpose of ergonomics is to enable a work system to function better by improving the interactions between users and machines. Better functioning can be defined more closely, for example, as more output from fewer inputs to the system (greater 'productivity') or increased reliability and efficiency (a lower probability of inappropriate interactions between the system components). The precise definition of better functioning depends on the context. Improved machine performance that increased the psychological or physical stress on workers or damaged the local environment would not constitute improved performance of the total work system or better attainment of its goals.[1]

Anatomy:

The shoulder is the region of upper limb attachment to the trunk. The bone framework of the shoulder consists of the clavicle and scapula, which form the pectoral girdle (shoulder girdle) and the proximal end of the humerus.
These joints provide extensive range of motion to the upper extremity, thereby increasing the ability to "reach and manipulate object.
The shoulder girdle (clavicle and scapula) connects the bones of the upper limb to the thoracic cage and the glenoid fossa in the scapula connects the proximal humerus and forms the complete shoulder joint complex. The important in the shoulder joint is Glenohumeral joint.

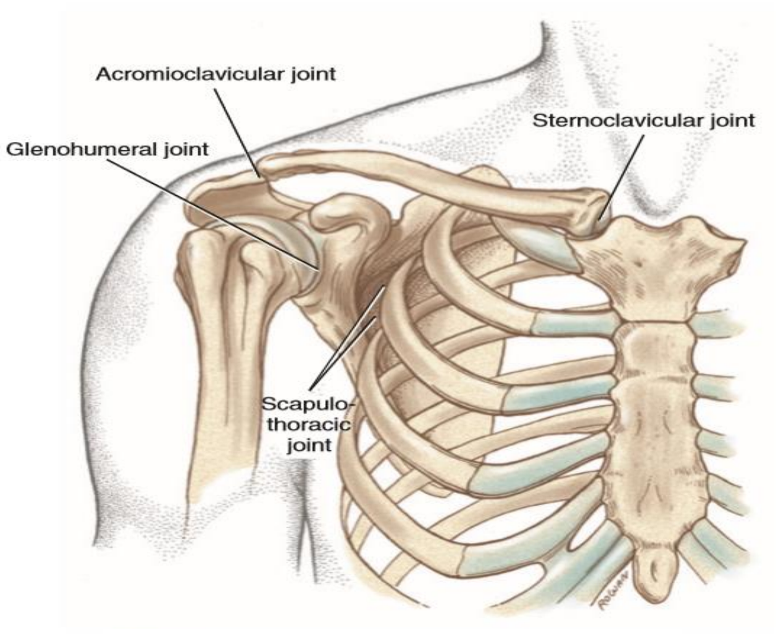


Figure (2)

Ligaments of the shoulder jont :

■ Anterosuperiorly in three locations to form superior, middle, and inferior (glenohumeral ligaments) which pass from the superomedial margin of the glenoid cavity to the lesser tubercle and inferiorly related anatomical neck of the humerus.
■ Superiorly between the base of the coracoid process and the greater tubercle of the humerus (the coracohumeral ligament).
■ Between the greater and lesser tubercles of the humerus (transverse humeral ligament) this holds the tendon of the long head of the biceps brachii muscle in the intertubercular sulcus.

Muscles Of the shoulder girdle:

The two most superficial muscles of the shoulder are the trapezius and deltoid muscles. Together, they provide the characteristic contour of the shoulder:

■ The trapezius attaches the scapula and clavicle to the trunk.

■ The deltoid attaches the scapula and clavicle to the humerus.

Trapezius: the trapezius muscle has an extensive origin from the axial skeleton, which includes sites on the skull and the vertebrae, the muscle attaches to the vertebrae through the ligamentum nuchae. The muscle inserts onto the skeletal framework of the shoulder along the inner margins of a continuous U -shaped line of attachment oriented in the horizontal plane, with the bottom of the U directed laterally. The trapezius muscle is a powerful elevator of the shoulder and also rotates the scapula to extend the reach superiorly.

Deltoid: The deltoid muscle is large and triangular in shape, with its base attached to the scapula and clavicle and its apex attached to the humerus. It originates along a continuous U-shaped line of attachment to the clavicle and the scapula, mirroring the adjacent insertion sites of the trapezius muscle. It inserts into the deltoid tuberosity on the lateral surface of the shaft of the humerus. The major function of the deltoid muscle is abduction of the arm beyond the initial 15 ° accomplished by the supraspinatus muscle.

Levator scapulae: The levator scapulae originates from the transverse processes of CI to CIV vertebrae. It descends laterally to attach to the posterior surface of the medial border of the scapula from the superior angle to the smooth triangular area of bone at the root of the spine.

The rhomboid minor and major muscles: attach medially to the vertebral column and descend laterally to attach to the medial border of the scapula inferior to the levator scapulae muscle. The rhomboid minor originates from the lower end of the ligamentum nuchae and the spines of CVII and TI vertebrae. It inserts laterally into the smooth triangular area of bone at the root of the spine of the scapula on the posterior surface.

Supraspinatus and infraspinatus: The supraspinatus and infraspinatus muscles originate from two large fossae, one above and one below the spine, on the posterior surface of the scapula, they form tendons that insert on the greater tubercle of the humerus.

Teres minor and majors: The teres minor muscle is a cord-like muscle that originates from a flattened area of the scapula immediately adjacent to its lateral border below the infraglenoid tubercle. Its tendon inserts on the inferior facet of the greater tubercle of the humerus. The teres minor laterally rotates the humerus and is a component of the rotator cuff.

The teres major muscle: Originates from a large oval region on the posterior surface of the inferior angle of the scapula. This broad cord-like muscle passes superiorly and laterally and ends as a flat tendon that attaches to the medial lip of the intertubercular sulcus on the anterior surface of the humerus. The teres major medially rotates and extends the humerus.

Long head of triceps brachii: The long head of triceps brachii muscle originates from the

infraglenoid tubercle and passes somewhat vertically down the arm to insert, with the medial and lateral heads of this muscle on the olecranon of the ulna.

The triceps brachii is the primary extensor of the forearm at the elbow joint. Because the long head crosses the glenohumeral joint, it can also extend and adduct the humerus.

Subclavius: The subclavius muscle is a small muscle that lies deep to the pectoralis major muscle and passes between the clavicle and rib I. It originates medially, as a tendon, from rib I at the junction between the rib and its costal cartilage. It passes laterally and superiorly to insert via a muscular attachment into an elongate shallow groove on the inferior surface of the middle third of the clavicle. The function of the subclavius is not entirely clear, but it may act to pull the shoulder down by depressing the clavicle and may also stabilize the sternoclavicular joint by pulling the clavicle medially.

Pectoralis minor: The pectoralis minor muscle is a small triangular-shaped muscle that lies deep to the pectoralis major muscle and passes from the thoracic wall to the coracoid process of the scapula. It originates as three muscular slips from the anterior surfaces and upper margins of ribs III to V and from the fascia overlying muscles of the related intercostal spaces. The muscle fibers pass superiorly and laterally to insert into the medial and upper aspects of the coracoid process, the pectoralis minor muscle protracts the scapula (by pulling the scapula anteriorly on the thoracic wall) and depresses the lateral angle of the scapula.

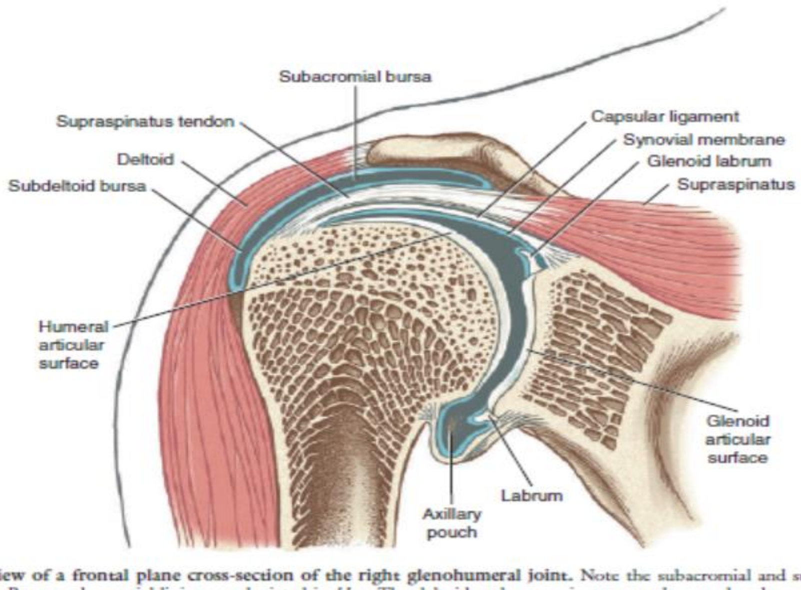
Subscapularis: The subscapularis muscle forms the largest component of the posterior wall of the axilla. It originates from, and fills, the subscapular fossa and inserts on the lesser tubercle of the humerus, the tendon crosses immediately anterior to the joint capsule of the glenohumeral joint. Together with three muscles of the posterior scapular region (the supraspinatus, infraspinatus, and teres minor muscles), the subscapularis is a member of the rotator cuff muscles, which stabilize the glenohumeral joint.

Coracobrachialis: The coracobrachialis muscle, together with the short head of the biceps brachii muscle, originates from the apex of the coracoid process It passes vertically through the axilla to insert on a small linear roughening on the medial aspect of the humerus, approximately midshaft. The coracobrachialis muscle flexes the arm at the glenohumeral joint .[2]

Applied anatomy:

The **glenohumeral joint** is a multiaxial, ball-and-socket, synovial joint that depends primarily on the muscles and ligaments rather than bones for its support, stability,and integrity.1 Thus, the assessment of the muscles and ligaments/capsule can play a major role in the assessment of the shoulder. The **labrum,** which is the ring of fibrocartilage, surrounds and deepens the glenoid cavity of the scapula about 50% (Figure 3). Only part of the humeral head is in contact with the glenoid at any one time. This joint has three axes and three degrees of freedom. The resting position of the glenohumeral joint is 55° of abduction and 30° of horizontal adduction. The close packed position of the joint is full abduction and lateral rotation. When relaxed, the humerus sits centered in the glenoid cavity; with contraction of the rotator cuff muscles, it is pushed or translated anteriorly, posteriorly, inferiorly, of the joint is full abduction and lateral rotation. When relaxed, the humerus sits centered in the glenoid cavity; with contraction of the rotator cuff muscles, it is pushed or translated anteriorly, posteriorly, inferiorly, superiorly, or in any combination of these movements. This movement is small, but if it does not occur, full movement is impossible. The glenoid in the resting position has a 5° superior tilt or inclination and a 7° retroversion (slight medial rotation). The angle between the humeral neck and shaft is about 130°, and the humeral head is retroverted 30° to 40° relative to the line joining the epicondyle.

The primary ligaments of the glenohumeral joint—the superior, middle, and inferior glenohumeral ligaments play an important role in stabilizing the shoulder.The superior glenohumeral ligament's primary role is limiting inferior translation in adduction. It also restrains anterior translation and lateral rotation up to 45° abductions. The middle glenohumeral ligament, which is absent in 30% of the population, limits lateral rotation between 45° and 90° abductions. The inferior glenohumeral ligament is the most important of the three ligaments. It has an anterior and posterior band with a thin "axillary pouch" in between, so it acts much like a hammock or sling. It supports the humeral head above 90° abductions, limiting inferior translation while the anterior band tightens on lateral rotation and the posterior band tightens on medial rotation. Excessive lateral rotation, as seen in throwing, may lead to stretching of the anterior portion of the ligament (and capsule), thereby increasing glenohumeral laxity. The coracohumeral ligament primarily limits inferior translation and helps limit lateral rotation below 60° abduction. This ligament is found in the rotator interval between the anterior border of the supraspinatus tendon and the superior border of the subscapularis tendon, thus the ligamentUnites the two tendons anteriorly. The **rotator interval** consists of fibers of the coracohumeral ligament, superior glenohumeral ligament, glenohumeral



Anterior view of a frontal plane cross-section of the right glenohumeral joint. Note the subacromial and subdeltoid bursa within the subacromial space. Bursa and synovial lining are depicted in *blue*. The deltoid and supraspinatus muscles are also shown. (From Neuman DA: Kinesiology of the musculoskeletal system: foundations for rehabilitation, ed 2, St Louis, 2010, Mosby/Elsevier, p. 143.)

Figure (3)

and subscapularis. Injury to these structures can lead to contractures, biceps tendon instability, and anterior glenohumeral coracoacromial ligament forms an arch over the humeral groove to hold the long head of biceps tendon within head, acting as a block to superior translation. The instability limiting joint capsule, and part of the tendons of supraspinatus movement in different degrees of abduction. The the groove. The capsular pattern of the glenohumeral transverse humeral ligament forms a roof over the bicipital joint is lateral rotation most limited, followed by abduction and medial rotation. Branches of the posterior cord of the brachial plexus and the suprascapular, axillary, and lateral pectoral nerves innervate the joint.

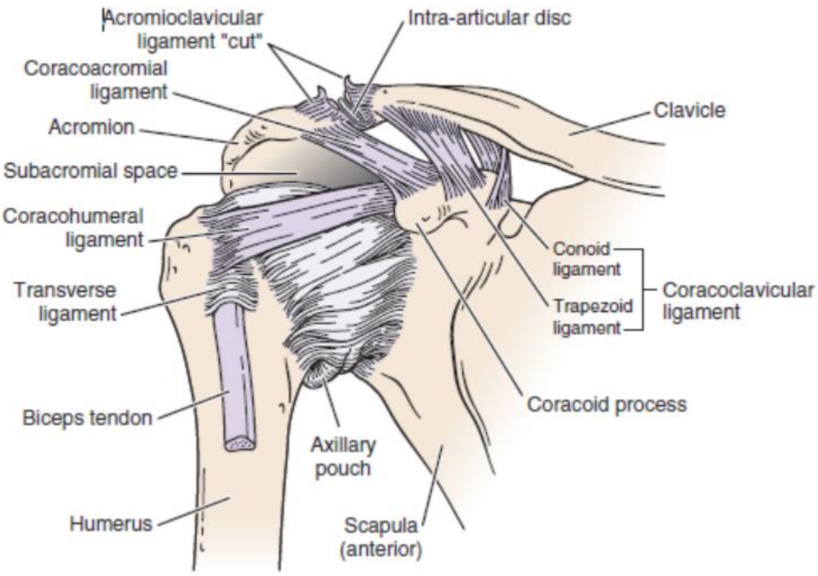
The acromioclavicular joint is a plane synovial joint that augments the range of motion (ROM) of the humerus in the glenoid (Figure 4). The bones making up this joint are the acromion process of the scapula and the lateral end of the clavicle. The acromion may have different undersurface shapes or types: type I—flat (17%), type II—curved (43%), type III—hooked (39%), and type IV—convex (upturned) (1%). About 70% of rotator cuff tears are associated with a hooked acromion. Some believe the hooked acromion is not an anatomical variant but is the result of ossification of the coracoacromial ligament at its attachment to the acromion.

The joint has three degrees of freedom. The capsule, which is fibrous, surrounds the joint. An articular disc may be found within the joint. Rarely does the disc separate the acromion and clavicular articular surfaces. This joint depends on ligaments for its strength. The acromioclavicular ligaments surround the joint and control horizontal motion of the clavicle. These are commonly the first ligaments injured when the joint is stressed. The coracoclavicular ligament is the primary support of the acromioclavicular joint.

It has two portions: the conoid (medial) and trapezoid (lateral) parts, and they control the vertical motion of the clavicle. If a step deformity occurs, this ligament has been torn. In the resting position of the joint, the arm rests by the side in the normal, standing position. In the close packed position of the acromioclavicular joint, the arm is abducted to 90°. The indication of a capsular pattern in the joints pain at the extreme ROM, especially in horizontal adduction (cross-flexion) and full elevation. This joint is innervated by branches of the suprascapular and lateral pectoral nerve.

The sternoclavicular joint, along with the acromioclavicular joint, enables the humerus in the glenoid to move through a full 180° of abduction. It is a saddle-shaped synovial joint with 3° of freedom and is made up of the medial end of the clavicle, the manubrium sternum, and the cartilage of the first rib. It is the joint that joins the appendicular skeleton to the axial skeleton. A substantial disc is between the two bony joint surfaces, and the capsule is thicker anteriorly than posteriorly.

The disc separates the articular surfaces of the clavicle and sternum and adds significant strength to the joint because of attachments, thereby preventing medial displacement of the clavicle. Like the acromioclavicular joint, the joint depends on ligaments for its strength. The ligaments of the sternoclavicular joint include the anterior and posterior sternoclavicular ligaments, which support the joint anteriorly and posteriorly, the interclavicle ligament, and the cost clavicular ligament running from the costal cartilage. This is the main ligament maintaining the integrity of the sternoclavicular joint are possible at this joint and at the acromioclavicular joint are elevation, depression, protrusion, retraction, and rotation. The close packed position of the sternoclavicular joint is full or occurs when the upper arm is in full elevation. The resting position and capsular pattern are the same as with the acromioclavicular joint. The joint is innervated by branches of the anterior supraclavicular nerve and the nerve to the subclavius muscle. Major vessels and the trachea lie close behind the sternum and the sternoclavicular joint.



Anterior view of the right glenohumeral and acromioclavicular joints. Note the subacromial space or supraspinatus outlet located between the top of the humeral head and the underside of the acromion. (Modified from Neumann DA: Kinesiology of the musculoskeletal system: foundations for rehabilitation, St Louis, 2002, Mosby, p. 107.)

Figure (4)

Although the **scapulothoracic joint** is not a true joint, it functions as an integral part of the shoulder complex and must be considered in any assessment because a stable scapula enables the rest of the shoulder to function correctly. Some texts call this structure the scapulocostal joint. This "joint" consists of the body of the scapula and the muscles covering acting on the scapula help to control its movements. The medial border of the scapula is not parallel with the spinous processes bottom), and the scapula lies 20° to 30° forward relative to the sagittal plane. Because it is not a true joint, it does not have a capsular pattern nor a close packed position. The resting position of this joint is the same as for the acromioclavicular joint.

The scapula extends from the level of T2 spinous process to T7 or T9 spinous process, depending on the size of the scapula. Because the scapula acts as a stable base for the rotator cuff muscles, the muscles controlling its movements must be strong and legs into the arm. [3]

SPADI Scale:

The Shoulder Pain and Disability Index (SPADI) is a patient completed questionnaire with 13 items assessing pain level and extent of difficulty with ADLs requiring the use of the upper extremities.

The pain subscale has 5-items and the Disability subscale has 8-items.

The original version was published in 1991 and has its items scored on the Visual analogue scale while the second version scores its items on the Numerical rating scale(NRS)

SPADI can be used in the following patient population:

- ✓ Shoulder pain
- ✓ Rotator cuff disease
- ✓ Osteoarthritis
- ✓ Rheumatoid arthritis
- ✓ Frozen Shoulder
- ✓ Shoulder arthroplasty

Method of Use:

The patient is instructed to choose the number that best describes their level of pain and extent of difficulty using the involved shoulder. The pain scale is summed up to a total of 50 while the disability scale sums up to 80. The total SPADI score is expressed as a percentage. A score of 0 indicates best 100 indicates worst. A higher score shows more disability.
In scoring SPADI, any question missed should be taken out of the total score of each subscale. i.e. if 1 question is omitted in the pain section, the total score is divided by 40.

Reliability:

SPADI was found to have reliability coefficients of ICC ≥ 0.89 in a variety of patient populations. Internal consistency is high with Cronbach α typically exceeding 0.90.

Validity:

The SPADI demonstrates good construct validity, correlating well with other region-specific shoulder questionnaires. It has been shown to be responsive to change over time, in a variety of patient populations and is able to discriminate adequately between patients with improving and deteriorating conditions.[4]

Biomechanical aspect in sitting posture:

SPINE, SHOULDER GIRDLE, AND SHOULDER POSTURE:

Posture is generally thought of as relatively long-term, static positioning of the body segments. Habitual patterns of thoracic, scapular, and humeral posture will alter intra-articular and extra-articular stresses. For an individual, the effects of posture are cumulative from occupation, recreation, and sleeping. While external aids, like chairs, are important to a person’s posture, there are common patterns of posture that are believed to be associated with symptoms.[5]

In a clinical environment, evaluating the effects of standing posture on the cervical spine and shoulder starts at the feet. For sitting posture, normally the pelvis would be the starting point. This is a process of identifying the relative position and motions along anatomical segments and then considering the consequences.

A kinematic chain, in anatomical terms, can be understood as the physiological, performance, or functional effects as a consequence of the position of one anatomical segment relative to another segment. When interpreting positions and motions, we often are attempting to understand the kinetic chain, defined as the effects of forces and torques across anatomical segments. As other chapters in this book cover the lower extremities and lumbar spine, we will begin with the implications of thoracic spine posture on shoulder function.

While the fundamental ergonomic principles used to identify risk factors for repetitive strain injury, including frequency, intensity, and duration, are equally valid for the neck and shoulder regions, long-term postures are perhaps more relevant to determine neck and shoulder pain compared to other regions. **Schuldt, et al** studied the biomechanics and muscular function of the cervical spine, skilled women workers simulated standardized electromechanical assembly work in eight sitting postures.[6] Normalized electromyography was used to quantify activity in neck-and-shoulder muscles. With the whole spine flexed, muscle activity in the cervical erector spinae, trapezius and thoracic erector spinae muscles was higher than when the whole spine was straight and vertical. The posture with the trunk slightly inclined backward and neck vertical gave the lowest activity levels. Flexed neck compared to vertical neck gave higher activity in the cervical erector spinae. Work with abducted arm gave high neck muscle activity. Work postures can thus be optimized to diminish neck muscle load. Two ergonomic acids were studied during the work cycle. Elbow support reduced the activity in the trapezius and thoracic erector spinae integrated into it at the design stage. Human requirements are therefore system requirements rather than secondary considerations and can be stated in general terms rhomboids muscles in the posture with the whole spine flexed and in the posture with the whole spine vertical. Arm suspension gave mainly similar reduction in these postures, and also a reduction in the cervical erector spinae. In the position with the trunk slightly inclined backward, arm suspension gave a reduction in the trapezius.

These findings indicate that arm support or arm suspension can be used to reduce neck muscle load. Three methodological studies related to neck muscle load and normalization were included. 1) Examination of the effect of different isometric maximum test contractions on neck muscles showed that all contractions activated all muscles studied, including those on the contralateral side, to some extent and at various levels. The highest frequency of attained maximum levels was: for neck extension, in cervical erector spinae; for cervical spinae lateral flexion, in splenius and levator scapulae; for arm abduction, in trapezius, and, for shoulder elevation and scapular retraction/elevation, in thoracic erector spinae/rhomboids. Proximal resistance gave higher activity than distal. 2) The relationship between EMG activity and muscular moment was studied in women during submaximal and maximum isometric neck extension. The relationship found was non-linear, with greater increase in activity at high moments in the posterior neck muscles studied. The slightly flexed cervical spine position induced a higher level of activity in erector spinae cervicalis than did the neutral position for a given relative muscular moment. 3) Muscular activity was related to cervical spine position during maximum isometric neck extension. Peak activity in the cervical erector spinae was found in the slightly flexed lower-cervical spine position.

The cervical spine is traditionally thought to form a gentle curve concave posteriorly. The thoracic spine is idealized as a gentle curve concave anteriorly. If one were to draw a vertical line from the ear downward, it should fall near the greater trochanter of the femur. Theoretically, the center of gravity of the head should be close to the skeletal base of support (e.g., the cervical bodies) in order to minimize the torque acting on each articulation. The articulations should be in a midrange, not at the end point of flexion or extension in the sagittal plane.

The male subject in Figure 11.1 demonstrates a high degree of thoracic kyphosis and consequently the cervical spine must have excessive extension to position the eyes.

The ears are far ahead of the acromion process. The female in Figure 11.1 demonstrates that a flat mid thoracic and increased upper thoracic and lower cervical spine flexion spine is her normal posture. Neither posture matches the traditionally ideal posture. Both spinal postures have consequences on the scapular position described below.

Figure (5) illustrates two markedly different sitting postures. Traditionally we think of an ideal posture in the sagittal plane as maintaining the ear lobe over the acromion process.

FIGURE (5) Slouch and erect sitting postures. These images highlight three postural differences between the two subjects: A marked crease at the C6–C7 region of the cervical spine (A), a forwardly rotated, winged right scapula (B), and a flat thoracic spine (C).

A relatively passive activity led to a cumulative strain injury of my shoulder in my days as a graduate student in anatomy. Certainly, the problem rated as injury because the symptoms were significant and it interfered with other aspects of my life including writing. Processing tissue samples for electron microscopic analysis kept my right upper extremity elevated. It seems odd that the stress of making glass knives or sectioning tissue would be more injurious to my shoulder compared to competitive cross-country skiing. The answer to this paradox is associated with the long-term static positioning.

HUMERUS:

The glenohumeral joint is typically described as a shallow ball and socket joint with the socket deepened by a fibrocartilage labrum. To complicate the ball and socket arrangement of the humerus on the scapula, there is a bony shelf over the superior
portion on the "socket" side of the joint, the acromion process, on the "ball" side, the greater tubercle is another obstacle that limits symmetrical rotation in all three dimensions. Consequently, some positions of the glenohumeral joint are limited [30]and potentially injurious to the shoulder. In addition, intrinsic changes to the glenohumeral joint, such as posterior or anterior stiffness, cause changes in glenohumeral rhythm as well as changes in the way the humeral head moves relative to the glenoid fossa.

When the person's elbow is extended, the hand is rotated in the horizontal plane primarily by shoulder rotation rather than forearm pronation and supination. In positions of the arm-reachable workspace around 90° of flexion and above, commonly called impingement positions, positioning the palm down can cause shoulder pain for susceptible people.
Clinical and physical tests of the shoulder joint take advantage of positions that can provoke symptoms in impingement tests such as the Kennedy-Hawkins tests.

When people reach to shoulder height or above, they may rotate their palms downward, and may be aggravating their shoulders by reproducing the impingement tests in their working or home environments. Clinically, the preferred workspace for the upper extremity is a short diagonal arc. The highest medial position would be similar to touching the index finger to the nose.

The most infer lateral position is similar to the anatomical position with the arms abducted to about 30° in the coronal plane. Arm positions to avoid include horizontal abduction and adducted positions.

DISEASE AND INJURY IN THE SHOULDER AS IT APPLIES TO ERGONOMICS:

Intrinsic factors, as part of the individual, interact with the working environment to culminate in neck and shoulder pain in some cases. So far, the discussion has been about the relative

joint positions in posture in relatively healthy individuals. However, many workers have injuries and diseases that accumulate over their working life, whether caused by their working activities or not. The following section will cover some of the common p problems either caused by the working environment or that are prevalent in the general population.

ROTATOR CUFF DISEASE AND INJURY:

While many are familiar with the rotator cuff muscles (supraspinatus, infraspinatus, teres minor, and subscapularis) with regard to their role in producing rotation at the glenohumeral joint movement, these muscles have several other functions in the shoulder. Since the tendons of the rotator cuff are bound to the shoulder joint capsule, tears in the rotator cuff tendons can cause shoulder instability. Also, coordination of upward motion of the glenohumeral joint requires muscular coordination, especially the rotator cuff. The rotator cuff applies an upward rotation of the humerus relative to the scapula, certain muscles of the group stabilize the humerus against an upward translation caused by the deltoid degenerative changes associated with aging, or injuries associated with sports, and the loss of rotator cuff functions are difficult to disassociate from injuries in the workplace.

SHOULDER INSTABILITY:

There are many possible diagnoses that identify specific direction or pathologies associated with instability at the glenohumeral articulation. While some diagnoses indicate gross disruption of joint stability, some of these diagnoses indicate a subtle change in the mechanism of connective tissues that stabilize the ball and socket geometry of the joint.

The term “minor instability” has been used to indicate a dysfunction of glenohumeral articulation, especially in combination with micro trauma that gives rise to shoulder symptoms. The syndrome of minor instability accents the common clinical concept that the shallow ball and socket geometry of the glenohumeral joint requires effective soft tissue and muscular function. The general population has a range of flexibility in the connective tissues. The generalized ligamentous laxity of the glenohumeral joint is believed to increase the risk of shoulder pain in certain activities.

REACHING:

Based on the preceding discussion, it would appear that to reduce neck and shoulder pain, the ideal reach in the working environment would have some standard characteristics. The thoracic spine would be supported in a way that would avoid slouching. The cervical spine would be held erect. The scapula would be slightly retracted and posteriorly rotated. The head of the humerus would avoid and anteriorly translated and internally rotated position. The arm would function in the ideal reachable space described above that comes to the midline of the body in a short arc.

In addition, one must consider the environmental and psychological stress on the working individual. **Sunisa Chaiklieng, et al** made a prospective cohort study to assess the incidence of shoulder pain following a survey study on baseline of health risk of shoulder pain (SP) among University office workers.[7]

A health risk assessment of SP was performed by using a risk matrix of covariation between ergonomics risk and discomfort level.
The results showed that most (51.1%) were found to have a moderate (21.2%), high (17.3%) or very high (12.6%) health risk of SP. By exclusion of cases with moderate to severe level of shoulder discomfort, 149 workers were followed up periodically for identification of the SP new cases. The cumulative SP incidence for all levels increased from 24.8% at the first month to 30.2% at second month. This research found that a high proportion of the office workers were exposed to the ergonomics risk of work-related SP which similar to the SP incidence. The suggestion is that the SP prevention, such as improvement in work posture and ergonomic designs of workstations, are needed

WORKPLACE ENVIRONMENT:

Beyond physical demands of the working activity, psychosocial and environmental demands can impact neck and shoulder symptoms. Physical comfort of the worker may contribute to the overall problem**. Rocha et al.** found that the thermal environment (comfort) was found to be associated with neck shoulder pain for call center workers. Only 28% of call center workers thought the thermal comfort of the environment was good or excellent.[8]

AIM AND GOALS

AIM AND GOALS

Aim of the study: To Know the prevalence of shoulder pain and disability among desktop workers.

Goals of the study:

- To identify the correlation of shoulder pain and year of work.
- To identify the correlation between shoulder disability and year of work.
- To identify the correlation between age and shoulder pain.
- To identify the correlation between age and shoulder disability.
- To identify the correlation between time of work in a day and shoulder pain.
- To identify the correlation between time of work in a day and shoulder disability.

METHODOLOGY

Methodology

Methods and materials:

This is a cross-sectional study was done in Azal university for human development and Yemen university and University of science and technology hospital between 28th February 2022 to 30th March 2022 after obtaining the permission from the higher administration and the physical therapy department. Totally 119 samples were volunteered. They were screened for inclusion and exclusion criteria

Inclusion criteria:

- NO previous history of shoulder fracture.
- NO previous history of cervical prolapse problem.
- Only desktop worker.
- NO history of previous shoulder sports trauma.
- NO history of previous tendinitis, Tendinopathy, dislocation before starting their career.
- More than 4 years of experience.
- More than 4 hours of work per day.

Exclusion criteria:

- History of shoulder fracture.
- History of bad sitting posture in normal occasion.
- History of cervical disc problem.
- Non desktop worker.
- History of shoulder sport trauma.
- History of Tendinitis, tendinopathy, Dislocation before work.
- Less than 4 years of experience.
- Less than 4 hours work per a day.
- History of Diabetes Mellitus.

There were 119 volunteers out of which 54 were males and 65 were females participated. The age group was from 20 to 60 with job profile using desktop in work and not the laptop. Stadiometer was used to measure the height of the participants and other anthropometric measurements were also taken.

We used SPADI scale for the identification of the pain and disability index and it's a questionnaire. All the participants were explained about the details of the research and how to use the SPADI questionnaire in Arabic and English language to avoid any confusions or misunderstanding. Then the SPADI questionnaire was filled by the participants. Then we calculate the percentage of pain and percentage of disability in shoulder using the method advised in the questionnaire and total percentage and score of SPADI also calculated using the formulae _____ / 130 X 100.

All the data were entered in the data sheet and then statistically analyzed using (SPSS version 25.0, Chicago, IL, USA).

STATISTICAL ANALYSIS

Statistical analysis

Table (1) Demographic characteristics of the study sample

Variable		N	%
Gender	Male	54	45.4%
	Female	65	54.6%
Age	20-30 years	72	60.5%
	31-40 years	39	32.8%
	More than 40 years	8	6.7%
Height (m)	1.40 to 1.50	9	7.6%
	1.51 to 1.60	42	35.3%
	1.61 to 170	50	42.0%
	above 1.70	18	15.1%
Hours of working	Less than 7 hours	31	26.1%
	7 to 10 hours	76	63.9%
	More than 10 hours	12	10.1%
Years of experience	Less than 5 years	29	24.4%
	5 to 10 years	64	53.8%
	11 to 15 years	16	13.4%
	More than 16 years	10	8.4%
Total pain score	0 to 10	24	20.2%
	11 to 20	38	31.9%
	21 to 30	36	30.3%
	31 to 40	15	12.6%
	More than 40	6	5.0%
Total pain score %	0% to 20%	24	20.2%
	21% to 40%	38	31.9%
	41% to 60%	36	30.3%
	61% to 80%	15	12.6%
	More than 80%	6	5.0%
Total disability score	0 to 10	30	25.2%
	11 to 20	16	13.4%
	21 to 30	20	16.8%
	31 to 40	25	21.0%
	More than 40	28	23.5%
Total disability score %	0% to 20%	46	38.7%
	21% to 40%	45	37.8%
	41% to 60%	22	18.5%
	61% to 80%	5	4.2%
	More than 80%	1	.8%
Total SPADI score	0 to 20	28	23.5%
	21 to 40	26	21.8%
	41 to 60	38	31.9%
	61 to 80	21	17.6%

Variable		N	%
	More than 80	6	5.0%
Total SPADI percentage	0% to 20%	36	30.3%
	21% to 40%	41	34.5%
	41% to 60%	33	27.7%
	61% to 80%	8	6.7%
	More than 80%	1	0.8%

It is clear from the table that the gender category (female) came with 54.6%, while the percentage of males came by 45.4%, and the age group (20-30 years) came in the first place with 60.5%, followed by the age group (31-40 years).

The height category (1.61 to 1.70) came at 42%, followed by the height category (1.51 to 1.60) by 35.3%, then the height category (above 1.70) by 15.1%, and finally the height category (1.40 to 1.50) by 7.6%.

The hours of working category (7 to 10 hours) came first with 63.9%, followed by (Less than 7 hours) with 26.1%, then the hours of working category (More than 10 hours) with 10.1%.

The years of experience category (5 to 10) came with a percentage of 53.8%, followed by a category (less than 5 years) with a percentage of 24.4%, then a category (11 to 15) with a percentage of 13.4%.

The total pain score category (11 to 20) came with a percentage of 31.9%, followed by a category (21 to 30) with a percentage of 30.3%, then a category (0 to 10) with a percentage of 20.2%.

The total disability score category (0 to 10) came with a percentage of 25.2%, followed by a category (more than 40) with a percentage of 23.5%, then a category (31 to 40) with a percentage of 21%.

The total SPADI score category (41 to 60) came first with 63.9%, followed by (0 to 20) with 23.5%, then the total SPADI score category (21 to 40) with 21.8%.

Are there differences between males and females for total pain score, total disability score and total SPADI percentage?

Table (2) Independent Samples Test for the male and female for pain score, disability score and SPADI

	Gender	N	Mean	Std. Deviation	Sig.
Total pain score %	Male	54	36.15	18.985	**.049***
	Female	65	43.72	22.735	
Total disability score %	Male	54	22.27	18.260	**.002***
	Female	65	33.12	19.237	
Total SPADI percentage	Male	54	27.57	16.620	**.005***
	Female	65	37.11	19.658	

The Independent Samples Test has been used to see if there are differences between males and females for total pain score, total disability score and total SPADI percentage and results were there are statistically significant differences at a lesson level less than 0.05. These differences were in favor of the female's gender.

Are there differences between ages for total pain score, total disability score and total SPADI percentage?

Table (3) Anove Test for the ages for pain score, disability score and SPADI

	Age	N	Mean	Std. Deviation	F	Sig.
Total pain score %	20-30 years	72	41.39	19.909	**.467**	**.628**
	31-40 years	39	37.64	22.978		
	More than 40 years	8	43.25	27.359		
Total disability score %	20-30 years	72	27.73	18.563	**.077**	**.926**
	31-40 years	39	29.20	22.432		
	More than 40 years	8	27.50	12.973		
Total SPADI percentage	20-30 years	72	32.89	17.832	**.012**	**.988**
	31-40 years	39	32.44	21.256		
	More than 40 years	8	33.45	18.135		

The Anove Test has been used to see if there are differences between ages for total pain score, total disability score and total SPADI percentage and results were there aren't statistically significant differences at a lesson level less than 0.05.

Are there differences between Heights for total pain score, total disability score and total SPADI percentage?

Table (4) Anove Test for the heights for pain score, disability score and SPADI

	Height (m)	N	Mean	Std. Deviation	F	Sig.
Total pain score %	1.40 to 1.50	9	39.11	17.266	**.498**	**.684**
	1.51 to 1.60	42	43.05	23.508		
	1.61 to 170	50	37.72	19.704		
	above 1.70	18	41.56	23.157		
Total disability score %	1.40 to 1.50	9	27.36	15.618	**1.718**	**.167**
	1.51 to 1.60	42	33.57	20.096		
	1.61 to 170	50	25.05	17.431		
	above 1.70	18	24.79	23.644		
Total SPADI percentage	1.40 to 1.50	9	31.75	15.880	**1.191**	**.316**
	1.51 to 1.60	42	37.12	20.295		
	1.61 to 170	50	29.85	16.801		
	above 1.70	18	31.31	21.765		

The Anove Test has been used to see if there are differences between heights for total pain score, total disability score and total SPADI percentage and results were there aren't statistically significant differences at a lesson level less than 0.05.

Are there differences between hours of working for total pain score, total disability score and total SPADI percentage?

Table (5) Anove Test for the hours of working for pain score, disability score and SPADI

	Hours of working	N	Mean	Std. Deviation	F	Sig.
Total pain score %	Less than 7 hours	31	43.29	25.972	**.590**	**.556**
	7 to 10 hours	76	38.68	19.453		
	More than 10 hours	12	42.67	20.703		
Total disability score %	Less than 7 hours	31	32.94	22.215	**1.335**	**.267**
	7 to 10 hours	76	26.18	17.756		
	More than 10 hours	12	28.65	22.089		
Total SPADI percentage	Less than 7 hours	31	36.86	22.432	**1.117**	**.331**
	7 to 10 hours	76	30.93	17.269		
	More than 10 hours	12	33.99	18.584		

The Anove Test has been used to see if there are differences between hours of working for total pain score, total disability score and total SPADI percentage and results were there aren't statistically significant differences at a lesson level less than 0.05.

Are there differences between years of experience for total pain score, total disability score and total SPADI percentage?

Table (6) Anove Test for the years of experience for pain score, disability score and SPADI

	Years of experience	N	Mean	Std. Deviation	F	Sig.
Total pain score %	Less than 5 years	29	38.34	17.114	**0.757**	**0.520**
	5 to 10 years	64	41.19	21.525		
	11 to 15 years	16	35.63	23.269		
	More than 16 years	10	47.60	28.516		
Total disability score %	Less than 5 years	29	26.85	18.563	**0.204**	**0.893**
	5 to 10 years	64	28.87	19.550		
	11 to 15 years	16	26.09	19.278		
	More than 16 years	10	31.13	24.234		
Total SPADI percentage	Less than 5 years	29	31.17	16.906	**0.466**	**0.707**
	5 to 10 years	64	33.54	19.037		
	11 to 15 years	16	29.64	18.682		
	More than 16 years	10	37.63	24.685		

The Anove Test has been used to see if there are differences between years of experience for total pain score, total disability score and total SPADI percentage and results were there aren't statistically significant differences at a lesson level less than 0.05.

Results:

The table 1 represents the demographic distribution of the samples and regarding table 2 the differences between males and females for total pain score, total disability score and total SPADI percentage using the Independent Samples Test shows that there are differences between males and females for total pain score, total disability score and total SPADI percentage and results were there are statistically significant differences at level less than 0.05. These differences were in favor of the female gender. Secondly towards table 3,4,5,6 which is telling about the differences between age, height, working hours and year of experience for total pain score, total disability score and total SPADI percentage using Anova Test and results were not statistically significant differences at a lesson level less than 0.05. The reason maybe, the distribution of samples were concentrated more while dividing the samples in group and not equally distributed.

DISCUSSION & CONCLUSION

Discussion & Conclusion

This the only study done in Yemen relating to the ergonomic issues of office workers. But it was focused only on shoulder. The result made a change as no significant difference with age and height even with experience and work hours is telling that the samples distribution is important and should be done in a bigger population of samples. This study provides an information about the female gender getting lot of issues by using desktop. It can be due to the seating arrangement impact due to height. Also, the study is clear that the younger generation less than age 30 are using the desktop common in work. So whenever a patient visits physical therapy unit with neck pain or wrist pain and if they use desktop in work, then the therapist should evaluate the shoulder also. This is a good awareness from this study.

LIMITATION

AND

RECOMMENDATION

Limitation and Recommendation

Every study will have a limitation and also there will be recommendation. In the same way, in our study we had limitation because many samples had problem in spine due to the habit of cultural sitting habit by leaning on one side. Then, the emergence of laptop usage is more comparing to desktop usage, which makes a lot of samples to be excluded as well as we faced a big difficulty to obtain the Books which related to our topic specifically shoulder ergonomics. At the end the sample size is also small which makes the result variation.

Regarding the flaws, we noted, we want to make recommendation to make samples more to have a chance for equal distribution. Then to make study towards population using laptops as it is the common source now even in offices. Also, to make study focusing on related joints like neck, elbow too to have a broad picture of the disability a person can undergo due to wrong ergonomics.

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Appendix

Shoulder pain and Disability Index (SPADI)

Shoulder Pain and Disability Index (SPADI)

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: 0 = no pain and 10 = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Total pain score _____ /50 × 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g., if 1 question missed divide by 40.)

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: 0 = no difficulty and 10 = so difficult it requires help.

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Total disability score: _____ /80 × 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g., if 1 question missed divide by 70.)

Total Spadi score: _____ 130 × 100 = _____ %

(Note: If a person does not answer all questions divide by the total possible score, e.g., if 1 question missed divide by 120.)

Minimum Detectable Change (90% confidence) = 13 points
(Change less than this may be attributable to measurement error)

5-49 Shoulder Pain and Disability Index (SPADI). (From Roach KE, Budiman-Mak E, Songsiridej N, et al: Development of a shc nd disability index. Arthritis Care Res 4[4]:143–149, 1991.)

. Measuring tape

Figure (6)