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DETERMINATION OF MOMENT OF FORCE AT VARIOUS ANGLES OF BICEP MUSCLE AND TO CALCULATE ITS MECHANICAL ADVANTAGE.

Aim : To determine the moment of force at various angles of bicep muscle and to calculate its mechanical advantage.

Apparatus required :-

i) A set of free weights
ii) Protractor
iii) Scale.

THEORY

The equation related to finding the moment of force

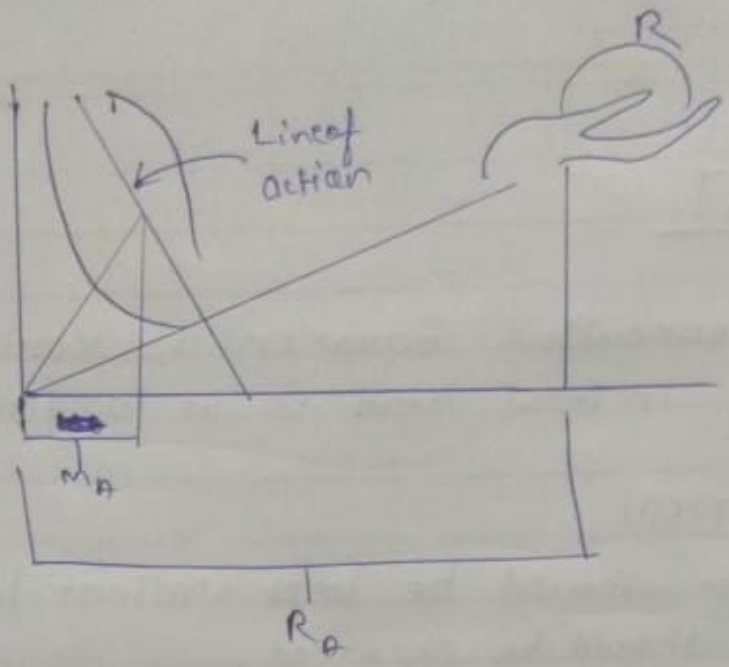
$$M \times M_A = R \times R_A$$

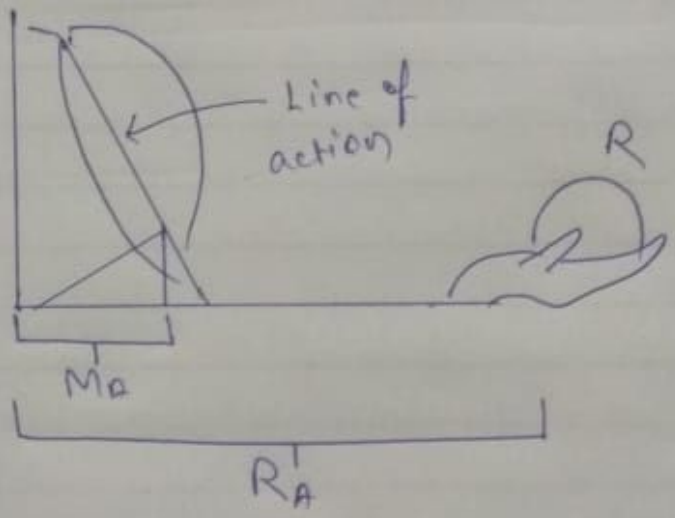
M = moment of force (or) torque
M_A = its the movement arm or the perpendicular distance from line of action.

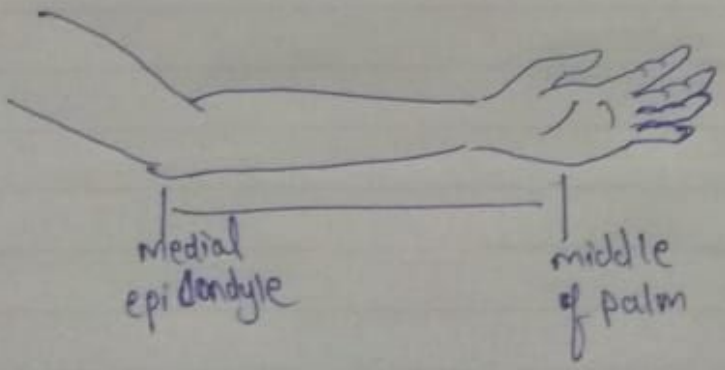
R = Resistance force / Load to be lifted.
R_A = it is the perpendicular distance from the load.

M_A is 2.54 cm from the elbow to the insertion and 5 cm from elbow for females and males respectively at 0° angle.

Teacher's Signature _____


R
Line of action
M_A
R_A


Line of action
R
M_A
R_A


Medial epicondyle
middle of palm

R_A, at an angle of 0° is the length of the forearm. At other angles both R_A & M_A changes.

- The movement of the elbow joint is uni-directional and provide more stable force and less injury. Whereas due to multiple rotation quality of shoulders it can easily get injured.

PROCEDURE

→ Measure the length of the forearm from the bony joint of the elbow to the centre of the palm as to calculate the resistance arm that is needed for calculation. To find where the joint is, please flex your elbow and with the help of thumbs and forefingers try to feel the joint and where you feel the bones moving that is the medial epicondyle.

→ Plot this right forearm length (R_A) on x-axis and right arm on the y-axis.

→ Plot the graph of M_A by calculating its distance from the elbow joint to the bicep insertion. on x-axis. It is 2.54cm for females and 5 cm for males.

→ Use a protractor to mark the 0°, 30°, 45°, 60° & 90° align the protractor with x-y axis and then draw lines to the following degrees of equal length.

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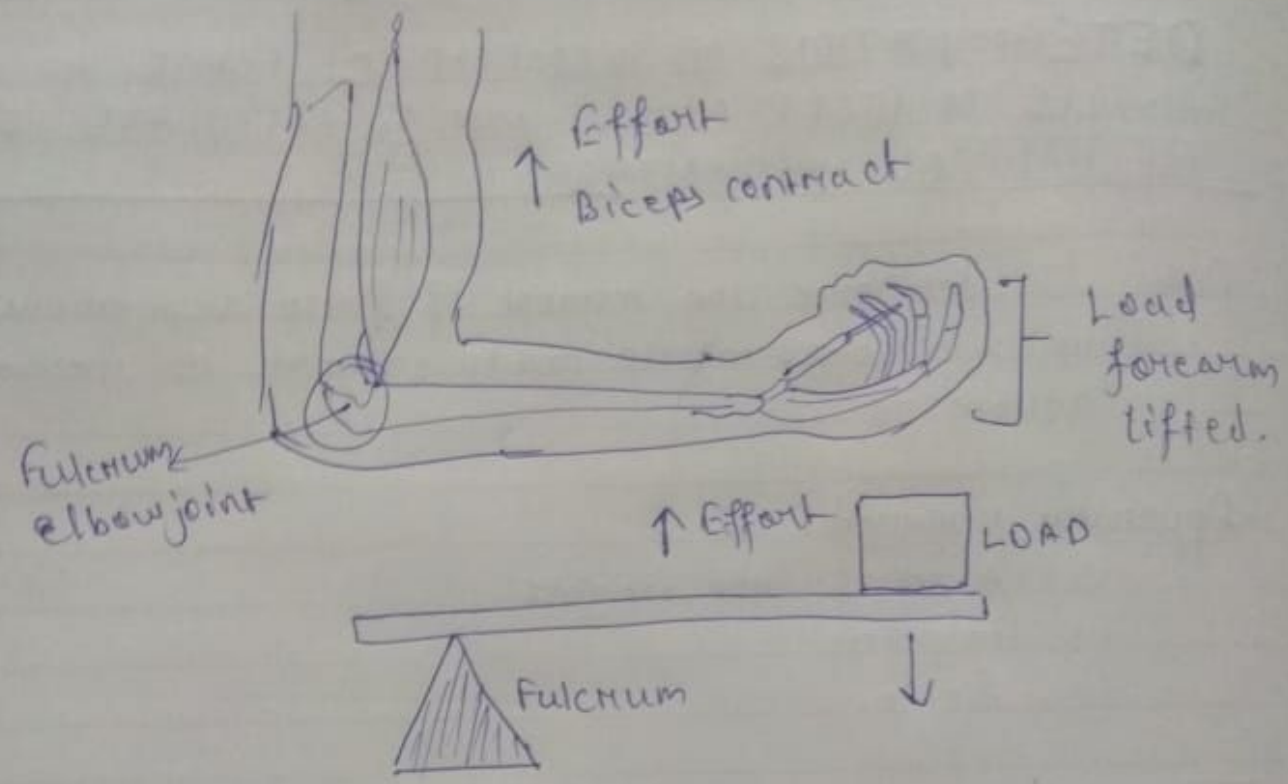
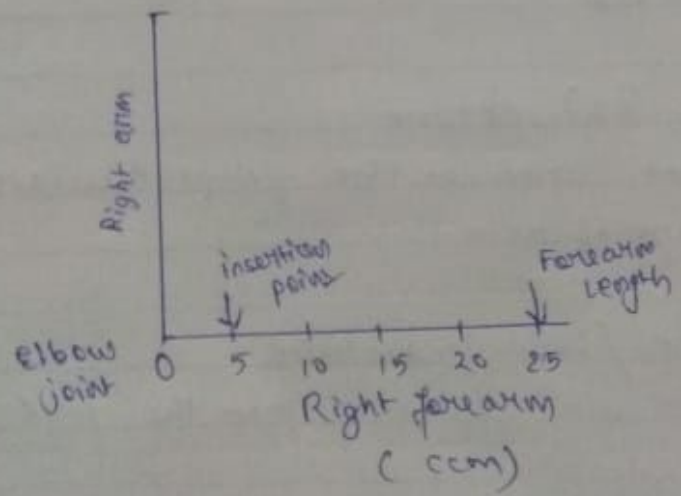
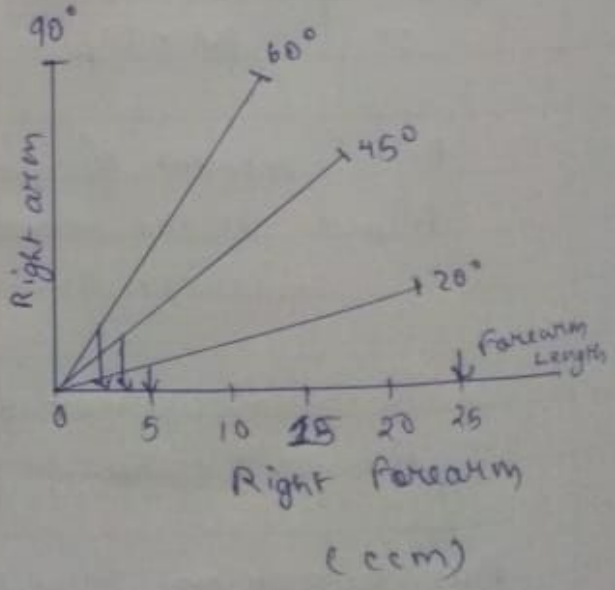

Effort
Biceps contract
Load
forearm
lifted.
Fulcrum
elbow joint
Effort
LOAD
Fulcrum


Right arm
insertion point
Forearm Length
Elbow joint
0
5
10
15
20
25
Right forearm
(cm)


90°
60°
45°
20°
Right arm
Forearm Length
0
5
10
15
20
25
Right forearm
(cm)

OBSERVATION :-

SNo.	Angle with Horizontal	Max weight at Might arm	Max wt at left arm	Moment arm		Resistance arm		Moment of force.		
				Right (cm)	Left (cm)	Right (R_A)	left (R_A)	left	Right	avg
1	0°	1	1	5	5	30	30	18.00	18.00	18
2	30°	1	1	4.5	4.5	25	25	16.66	16.66	16.66
3	45°	1	1	3.5	3.5	20	20	17.14	17.14	17.14
4	60°	1	1	3	3	15	12.5	15.00	15.00	13.75
5										

Date

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→ Use a ruler to mark the point of muscle insertion on the line at each angle, the distance from the joint to the remaine same through all angles.

→ With the help of a protactor try to draw a perpendicular line from the point of muscle of insertion to the x-axis intersecting the axis at right angle. The distance from the joint to the intersection is the moment arm (M_A)

→ Compute all the data at each angle to find the moment of force.

If we wants to find the mechanical advantage the.

$$\text{Mechanical Advantage} = \frac{\text{Effort Arm}}{\text{Resistance Arm.}}$$

RESULT

The moment of force at various angles of bicep muscle & mechanical advantage.

Teacher's Signature