

FUGL-MEYER ASSESSMENT UPPER EXTREMITY (FMA-UE)

Assessment of sensorimotor function

Fugl-Meyer AR, Jaasko L, Leyman I, Olsson S, Steglind S: The post-stroke hemiplegic patient. A method for evaluation of physical performance. *Scand J Rehabil Med* 1975, 7:13-31.

A. UPPER EXTREMITY , sitting position					
I. Reflex activity		none	can be elicited		
Flexors: biceps and finger flexors (at least one)		0	2		
Extensors: triceps		0	2		
Subtotal I (max 4)					
<p>Verbal instructions: "Relax your arm, I will support it and test your reflexes"</p> <p>Biceps: Hand is resting on the lap, forearm in supination. Assessor taps own thumb placed over the biceps tendon.</p> <p>Finger flexors: Hand is resting on the lap, forearm in supination. Assessor taps own finger placed over the volar side of the subject's proximal phalanges.</p> <p>Triceps: Slight abduction/internal rotation in shoulder, underarm hanging freely. Assessor taps triceps tendon.</p>		Elicited reflex activity is determined by visual movement or palpation			
II. Volitional movement within synergies , without gravitational help		none	partial	full	
<p>Flexor synergy: Hand from contralateral knee to ipsilateral ear. From extensor synergy (shoulder adduction/ internal rotation, elbow extension, forearm pronation) to flexor synergy (shoulder abduction/ external rotation, elbow flexion, forearm supination).</p> <p>Extensor synergy: Hand from ipsilateral ear to the contralateral knee</p>	Shoulder	retraction	0	1	2
		elevation	0	1	2
		abduction (90°)	0	1	2
		external rotation	0	1	2
	Elbow	flexion	0	1	2
	Forearm	supination	0	1	2
	Shoulder	adduction/internal rotation	0	1	2
Elbow	extension	0	1	2	
Forearm	pronation	0	1	2	
Subtotal II (max 18)					
<p>Flexor synergy Verbal instructions: "Put your hand outside of the opposite knee, then bring your hand toward your ear (arm side), bring your elbow up to shoulder height, and keep your palm of the hand facing behind you (thumb up)". Initial position: Hand outside of the contralateral knee, underarm pronated, elbow extended, shoulder adducted. Assistance can be provided to take the starting position, no help during the test. Starting position is not required for the scoring. End position: Shoulder abducted at least 90°, shoulder girdle elevation and retraction, external rotation, elbow flexion and forearm supination sufficient to reach the ipsilateral ear with palm of the hand facing backward (thumb pointing upward).</p> <p>Extensor synergy Verbal instructions: "Hold your hand close to your ear (as in the end of the flexor synergy), from this position, bring your hand toward your opposite knee in a way that your elbow will be fully straightened and the palm of your hand is touching the outer part of your knee". Initial position: As the end position of the flexor synergy and the knees slightly apart. End position: As the start position of the flexor synergy. Shoulder adduction across midline, full elbow extension, internal rotation and forearm supination sufficient to touch outer part of the contralateral knee with the palm of the hand.</p>		<p>The task can be repeated several times to allow assessor to evaluate each part of the movement.</p> <p>Do not allow compensation with trunk.</p> <p>Fingers positions are not scored.</p> <p>To score 2, compare with the unaffected side.</p> <p>Assessor can assist the subject to attain the starting position.</p> <p>In extensor synergy, make sure that the movement is active (palpate pectoralis major, triceps tendon or give slight resistance in order to eliminate the gravitation)</p>			

III. Volitional movement mixing synergies, without compensation		none	partial	full
Hand to lumbar spine hand on lap	cannot perform or hand in front of ant-sup iliac spine hand behind ant-sup iliac spine (without compensation) hand to lumbar spine (without compensation)	0	1	2
Shoulder flexion 0°- 90° elbow at 0° pronation-supination 0°	immediate abduction or elbow flexion abduction or elbow flexion during movement flexion 90°, no shoulder abduction or elbow flexion	0	1	2
Pronation-supination elbow at 90° shoulder at 0°	no pronation/supination, starting position impossible limited pronation/supination, maintains starting position full pronation/supination, maintains starting position	0	1	2
Subtotal III (max 6)				
<p>Hand to lumbar spine Verbal instructions: "Place the back of your hand to your low back". Initial position: Seated toward front of the chair (to make space behind the back), hands on the lap. End position: Shoulder extension, internal rotation and elbow flexion sufficient to touch the center of the lumbar spine with the back of the hand. (ASIS – anterior superior iliac spine)</p> <p>Shoulder flexion 0°- 90° Verbal instructions: "Straighten your elbow fully at your side with thumb facing forward; keep your elbow straight during the entire movement, and raise your arm to the shoulder height". Initial position: Shoulder neutral, elbow extended to 0°, forearm in neutral position. End position: Pure shoulder flexion to 90°, maintains full elbow extension, forearm in neutral position.</p> <p>Pronation-supination Verbal instructions: "Bend your elbow to 90° (forearm horizontal and directed forward), without moving the rest of your arm, turn your palm up and down as far as you can". Initial position: Shoulder neutral, elbow flexed to 90°, forearm in neutral position. End position: Shoulder neutral, elbow flexed to 90°, full supination and pronation</p>		<p>Do not allow compensation with trunk or using pendulum movement of the arm.</p> <p>In shoulder flexion 0°- 90°: score 0, if the starting position with fully extended elbow cannot actively be obtained by the subject. Hand position, regarding pronation or supination is not considered in scoring</p> <p>To score 2, compare with the unaffected side.</p> <p>Assistance can be provided to ensure the subject understands how to perform the required movement, or to test the maximum range of motion, but no assistance is provided by the assessor when scoring.</p>		

IV. Volitional movement with little or no synergy		none	partial	full
Shoulder abduction 0 - 90° elbow at 0° forearm pronated	immediate supination or elbow flexion supination or elbow flexion during movement abduction 90°, maintains extension and pronation	0	1	2
Shoulder flexion 90° - 180° elbow at 0° pronation-supination 0°	immediate abduction or elbow flexion abduction or elbow flexion during movement flexion 180°, no shoulder abduction or elbow flexion	0	1	2
Pronation/supination elbow at 0° shoulder at about 30° flexion	no pronation/supination, starting position impossible limited pronation/supination, maintains start position full pronation/supination, maintains starting position	0	1	2
Subtotal IV (max 6)				
<p>Shoulder abduction 0 - 90° Verbal instructions: "Straighten your elbow fully at your side with your palm facing downward; from this position, keep your elbow straight and palm downward during entire movement, and raise your arm toward the side up to the shoulder height". Initial position: Shoulder neutral, elbow extended to 0°, forearm pronated. End position: Shoulder abduction to 90°, elbow extended to 0°, forearm pronated.</p> <p>Shoulder flexion 90° - 180° Verbal instructions: Bring and hold your arm straight out in front of your body, fully straighten your elbow, thumb facing upward; from this position, keep your elbow straight during entire movement, and raise your arm up over your head as far as you can". Initial position: Shoulder flexed to 90°, elbow extended to 0°, forearm neutral (thumb facing upward). End position: Shoulder flexed to 180°, elbow extended to 0°, forearm neutral (thumb facing backward).</p> <p>Pronation-supination Verbal instructions: "Straighten your arm in front of your body, keep your elbow straight during the entire task and turn your palm up and down as far as you can". Initial position: Shoulder flexion around 30°, elbow extended to 0°, forearm in neutral position. End position: Shoulder flexion around 30°, elbow extended to 0°, full supination and pronation</p>		<p>Do not allow compensation with trunk or internal and external rotation of the shoulder in pronation/supination</p> <p>Score 0, if the starting position cannot actively be obtained by the subject.</p> <p>To score 2, compare with the unaffected side.</p>		
V. Normal reflex activity assessed only if full score of 6 points is achieved in part IV; compare with the unaffected side		hyper	lively	normal
biceps, triceps, finger flexors	2 of 3 reflexes markedly hyperactive 1 reflex markedly hyperactive or at least 2 reflexes lively maximum of 1 reflex lively, none hyperactive	0	1	2
Subtotal V (max 2)				
<p>Instructions: Same as in Part I, Reflex activity.</p> <p>The reflex lively indicates a reflex activity which is slightly stronger than the reflex activity in the unaffected side; markedly hyperactive reflex activity indicates markedly stronger reflexes (e.g. reflexes can be elicited by slight tap or touch alone).</p>		Elicited reflex activity is determined by visual movement or palpation		
Total A (max 36)				

B. WRIST support may be provided at the elbow to take or hold the starting position, no support at wrist, check the passive range of motion prior testing		none	partial	full
Stability at 15° dorsiflexion elbow at 90°, forearm pronated shoulder at 0°	less than 15° active dorsiflexion dorsiflexion 15°, no resistance tolerated maintains dorsiflexion against resistance	0	1	2
Repeated dorsiflexion / volar flexion elbow at 90°, forearm pronated shoulder at 0°, slight finger flexion	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Stability at 15° dorsiflexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	less than 15° active dorsiflexion dorsiflexion 15°, no resistance tolerated maintains dorsiflexion against resistance	0	1	2
Repeated dorsiflexion / volar flexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Circumduction elbow at 90°, forearm pronated shoulder at 0°	cannot perform volitionally jerky movement or incomplete complete and smooth circumduction	0	1	2
Total B (max 10)				
<p>Stability at 15° dorsiflexion – elbow 90° Verbal instructions: “Bend your elbow to 90° (forearm horizontal and pointing forward), palm turned downward, from this position, without moving the rest of your arm, flex your wrist and hand upward and hold this position”. Now keep your hand firm in this position while I put a slight pressure with my two fingers against the back of your hand;”. Initial position: Shoulder neutral, elbow flexed to 90°, forearm pronated. End position: Shoulder neutral, elbow flexed to 90°, forearm pronated, at least 15° dorsiflexion at wrist.</p> <p>Repeated dorsiflexion / volar flexion - elbow 90° Verbal instructions: “Bend your elbow to 90° (forearm horizontal and pointing forward), palm turned downward, from this position, without moving the rest of your arm flex your wrist and hand up and down as far as you can, do it for several times”. Initial position: Shoulder neutral, elbow flexed to 90°, forearm pronated. End position: Shoulder neutral, elbow flexed to 90°, forearm pronated, full dorsiflexion and volar flexion of the wrist.</p> <p>Stability at 15° dorsiflexion - elbow 0° Verbal instructions: “Straighten your arm in front of your body, palm downward; from this position, keep your elbow straight during the entire task, flex your wrist and hand upward and hold this position”. Now keep your hand firm in this position while I put a slight pressure with my two fingers against the back of your hand;”. Initial position: Shoulder slightly flexed and/or abducted, elbow extended to 0°, forearm pronated. End position: Shoulder slightly flexed and/or abducted, elbow extended to 0°, forearm pronated, at least 15° dorsiflexion at wrist.</p> <p>Repeated dorsiflexion / volar flexion - elbow 0° Verbal instructions: “Straighten your arm in front of your body palm downward, keep your elbow straight during the entire task and flex your wrist up and down as far as you can”, do it for several times”. Initial position: Shoulder flexion around 30°, elbow extended to 0°, forearm in neutral position. End position: Shoulder flexion around 30°, elbow extended to 0°, full supination and pronation</p> <p>Circumduction - elbow 90° Verbal instructions: “Bend your elbow to 90° (forearm horizontal and pointing forward), palm turned downward, from this position, without moving the rest of your arm, make a circle with your hand by moving the wrist”. Initial position: Shoulder neutral, elbow flexed to 90°, forearm pronated. End position: Shoulder neutral, elbow flexed to 90°, complete circumduction at the wrist.</p>		<p>Assessor can assist the subject to attain and hold the starting position in shoulder and elbow, (support is applied under the elbow) and no support is allowed at the wrist.</p> <p>Finger position is not scored.</p> <p>To score 2, compare with the unaffected side.</p> <p>Repeated dorsiflexion / volar flexion: Movement in both directions is required to score 2. Full active range of motion throughout possible passive range of motion is scored as 2. If passive range of motion is 0, no active movement is possible and the score will be 0.</p> <p>Circumduction: score the circumduction to preferred direction.</p>		

C. HAND support may be provided at the elbow to keep 90° flexion, no support at the wrist, compare with unaffected hand, the objects are interposed, active grasp		none	partial	full
Mass flexion from full active or passive extension		0	1	2
Mass extension from full active or passive flexion		0	1	2
GRASP				
a. Hook grasp flexion in PIP and DIP (digits II-V), extension in MCP II-V	cannot be performed can hold position but weak maintains position against resistance	0	1	2
b. Thumb adduction 1-st CMC, MCP, IP at 0°, scrap of paper between thumb and 2-nd MCP joint	cannot be performed can hold paper but not against tug can hold paper against a tug	0	1	2
c. Pincer grasp, opposition pulpa of the thumb against the pulpa of 2-nd finger, pencil, tug upward	cannot be performed can hold pencil but not against tug can hold pencil against a tug	0	1	2
d. Cylinder grasp cylinder shaped object (small can) tug upward, opposition of thumb and fingers	cannot be performed can hold cylinder but not against tug can hold cylinder against a tug	0	1	2
e. Spherical grasp fingers in abduction/flexion, thumb opposed, tennis ball, tug away	cannot be performed can hold ball but not against tug can hold ball against a tug	0	1	2
Total C (max 14)				
<p>Mass flexion Verbal instructions: "Hold your elbow around 90°, open your hand, and then bend your fingers to make a full fist (thumb outside the fingers)" Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral, complete extension of the fingers. End position: Shoulder neutral, elbow flexed around 90°, forearm neutral, complete flexion of the fingers.</p> <p>Mass extension Verbal instructions: "Hold your elbow around 90°, from full fist, open your hand and extend your fingers as much as possible". Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral, complete flexion of the fingers. End position: Shoulder neutral, elbow flexed around 90°, forearm neutral, complete extension of the fingers.</p>		<p>Assessor can assist the subject to attain and hold the starting position in shoulder and elbow, (support is applied under the elbow) but no support is allowed at the wrist.</p> <p>In mass flexion and extension: assessor can assist the subject to attain the full extension and/or flexion prior the active movement.</p>		
GRASP		To score 2, compare with the unaffected side.		
<p>a. Hook grasp Verbal instructions: "Open your hand flat and straighten your fingers, from this position bend your fingers but not the knuckles of your hand, make your hand look like a hook or claw; hold this position when I put my fingers against your fingertips and draw away from you". Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral (thumb pointing upward), complete extension of the fingers. End position: Shoulder neutral, elbow flexed around 90°, forearm and wrist neutral, MCP II-IV (metacarpal joint) extended to 0°, almost full flexion of the digits 2-5 in PIP (proximal interphalangeal joint) and DIP (distal interphalangeal joint).</p> <p>b. Thumb adduction Verbal instructions: "Open your hand flat and straighten your fingers; from this position, keep your hand and fingers straight and bring your thumb against the base of your index finger; now hold this paper between your thumb and the side of your index finger at the level of MCP); now keep your fingers and knuckles straight while I gently pull the paper away (horizontal tug)".</p>		<p>Pincer, cylinder and spherical grasps include an active grasping of the object by the subject when the object is presented in close distance of the hand.</p> <p>To score 2, correct hand position needs to be maintained during the "tug".</p>		

<p>Initial position: Shoulder neutral, elbow flexed around 90°, forearm pronated, extension of the fingers and thumb.</p> <p>End position: Shoulder neutral, elbow flexed around 90°, forearm and wrist pronated, MCP and digits II-IV extended to 0°, thumb adducted against MCP and holding the paper.</p> <p>c. Pincer grasp, opposition,</p> <p>Verbal instructions: “Take the pencil from me between the pads of your thumb and index finger; hold it firmly while I pull it (upward)”.</p> <p>Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral, thumb and index finger extension sufficient to grasp the pencil.</p> <p>End position: Shoulder neutral, elbow flexed around 90°, forearm and wrist neutral, the pulpa of the thumb and index finger opposed, and holding the pencil.</p> <p>d. Cylinder grasp</p> <p>Verbal instructions: “Grasp the can and hold it in your hand with your fingers and palm tightly around and thumb on the other side of the can; hold it firmly while I pull it (upward)”.</p> <p>Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral, thumb and finger extension sufficient to grasp the can.</p> <p>End position: Shoulder neutral, elbow flexed around 90°, forearm and wrist neutral, the volar surface of the hand in contact with the can, thumb and fingers opposed.</p> <p>e. Spherical grasp</p> <p>Verbal instructions: “Grasp the tennis ball and hold it in your hand with your fingers and thumb opposite of each other; hold it firmly while I pull it away (opposite direction)”.</p> <p>Initial position: Shoulder neutral, elbow flexed around 90°, forearm neutral, thumb and finger extension sufficient to grasp the ball.</p> <p>End position: Shoulder neutral, elbow flexed around 90°, forearm and wrist neutral, the volar surface of the hand in contact with the ball; thumb and fingers opposed in slight flexion and abduction (ball is showing between the thumb and index finger).</p>	
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D. COORDINATION/SPEED , sitting, after one trial with both arms, eyes closed, tip of the index finger from knee to nose, 5 times as fast as possible		marked	slight	none
Tremor		0	1	2
Dysmetria	pronounced or unsystematic slight and systematic no dysmetria	0	1	2
		≥ 6s	2 - 5s	< 2s
Time start and end with the hand on the knee	6 or more seconds slower than unaffected side 2-5 seconds slower than unaffected side less than 2 seconds difference	0	1	2
Total D (max 6)				
<p>Verbal instructions: “Sit straight with your hand on your knee, while keeping your eyes closed, bring the tip of your index finger to the tip of your nose, as fast as possible, five times. I am going to take time”.</p> <p>Initial position and end position: Sitting straight, hand on the ipsilateral knee.</p> <p>Tremor and dysmetria: Can only be assessed and scored when 5 complete movements from the knee to nose (or close to nose) can be performed by the subject.</p> <p>Time: Start the stopwatch when the hand leaves the knee and stop the stopwatch when the hand is back on the knee after 5 repetitions.</p>		<p>Ensure that the subject understands the instructions (perform the task few times without timing before scoring).</p> <p>Do not allow compensation with trunk and/or head.</p> <p>Score 0 all parts when the task cannot be completed 5 times.</p>		

TOTAL A-D (max 66)	
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H. SENSATION , upper extremity eyes closed, compared with the unaffected side		anesthesia	hypoesthesia or dysesthesia	normal
Light touch	upper arm, forearm palmary surface of the hand	0 0	1 1	2 2
		less than 3/4 correct or absence	3/4 correct or considerable difference	correct 100%, little or no difference
Position small alterations in the position	shoulder elbow wrist thumb (IP-joint)	0 0 0 0	1 1 1 1	2 2 2 2
Total H (max12)				

I. PASSIVE JOINT MOTION , upper extremity, sitting position, compare with the unaffected side				J. JOINT PAIN during passive motion, upper extremity		
	only few degrees (less than 10° in shoulder)	decreased	normal	pronounced pain during movement or very marked pain at the end of the movement	some pain	no pain
Shoulder						
Flexion (0° - 180°)	0	1	2	0	1	2
Abduction (0°-90°)	0	1	2	0	1	2
External rotation	0	1	2	0	1	2
Internal rotation	0	1	2	0	1	2
Elbow						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Forearm						
Pronation	0	1	2	0	1	2
Supination	0	1	2	0	1	2
Wrist						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Fingers						
Flexion	0	1	2	0	1	2
Extension	0	1	2	0	1	2
Total (max 24)				Total (max 24)		

A. UPPER EXTREMITY	/36
B. WRIST	/10
C. HAND	/14
D. COORDINATION / SPEED	/ 6
TOTAL A-D (motor function)	/66

H. SENSATION	/12
I. PASSIVE JOINT MOTION	/24
J. JOINT PAIN	/24