MODULE BIOMECHANICS OF SPINE

Didactic Unit D: INSTRUMENTED ANALYSIS OF THE SPINE

D.4. How is a normal biomechanical assessment of the lumbar spine?

ACTIVITY:

Activity Assessment of the range of motion in lumbar flexion-extension using dual inclinometry

50-year old man

Profession: builder

UL dominance: right

History: no previous history of interest for the process

The man reports moderately severe low back pain for several months after a traffic accident. On examination, his condition is medically stable, and the X-ray shows degenerative changes at L4 and L5. He goes to the doctor to report his main problem: limitation of spinal mobility due to pain.

In the doctor's consulting room, there is a tool to measure spinal mobility and perform a biomechanical analysis, so he decides to assess the lumbar mobility in order to objectively control the degree of deficiency in his patient.

To do this, he uses two inclinometers. With the patient in a standing position, he locates the T12 spinous process and places one of the inclinometers on that point. He puts the other inclinometer in the centre of the sacrum. **NOTE: You can review the measuring protocol in didactic unit D.2.**

After measuring the flexion-extension mobility of the lumbar spine, the results shown in figure 1 were obtained for each repetition. Answer the following questions by calculating the missing data in the tables.

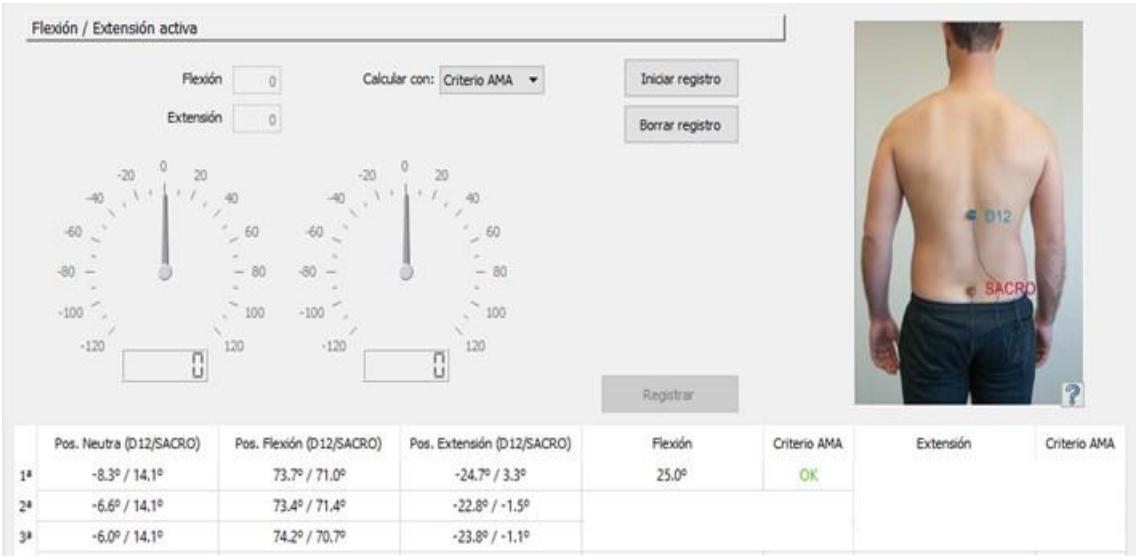

Figure 1

1. **Can you determine the real flexion of the lumbar spine?**

Using the calculation of the results of the first repetition included below as **help**, determine the real flexion of the lumbar spine in the 2nd and 3rd repetitions.

HELP: The **real flexion of the lumbar spine in the first repetition** is 25º. This result is obtained from the following data recorded by each inclinometer:

73.7º - (-8.3) = 82º of flexion by the inclinometer on D12

71º - 14.1º = 56.9º of flexion by the inclinometer on the sacrum

Therefore, the real lumbar flexion is 82º - 56.9º, which is approximately 25º

NOTE: You can also use what you learnt in didactic unit D.3 about range assessment using inclinometers.

Calculate the real lumbar flexion and the real lumbar extension of the 2nd and 3rd repetitions.

	Lumbar flexion	Lumbar extension
1st repetition	25º	
2nd repetition		
3rd repetition		

2. **Do these measurements meet the repeatability criteria established by the American Medical Association (AMA)?**

HELP: We help you with the first repetition of the real lumbar flexion.

The values determined for each repetition were 25º, 22º, and 23º. The average of the three repetitions is 23.34º. As this value (23.34º) is less than 50º, the value of the three consecutive repetitions of the flexion must fall within 5º from the mean. Consequently:

23.34 + 5º = 28.34º

23.34 – 5º = 18.34º

Therefore, the values obtained for the real lumbar flexion (25º, 22º and 23º) fall within 5º from the mean that is considered to be normal (18.34º - 28.34º). We can conclude that the result obtained is valid since it meets the repeatability criteria.

3. **Is it necessary to apply a straight leg raising validity test for this patient?**

HELP: We help you with the first repetition.

To confirm whether it is necessary or not, look at the results obtained by the inclinometer located on the sacrum for each repetition.

	Pos. Neutra (D12/SACRO)	Pos. Flexión (D12/SACRO)	Pos. Extensión (D12/SACRO)
1ª	-8.3º / 14.1º	73.7º / 71.0º	-24.7º / 3.3º
2ª	-6.6º / 14.1º	73.4º / 71.4º	-22.8º / -1.5º
3ª	-6.0º / 14.1º	74.2º / 70.7º	-23.8º / -1.1º

Figure 2

The values determined in the sacrum for the first repetition are:

71º (in flexion) and 3.3º (in extension); therefore, the flexion-extension range is:

71º - 3.3º = 67.7º

NOTE: Remember that the validity test is used if the flexion-extension movement of the sacrum inclinometer is less than 55º in men or less than 65º in women.

4. **Interpretation of the clinical case**

To complete the case assessed, the results obtained in the lateral flexions are as follows:

	Pos. Neutra (D12/SACRO)	Pos. Izquierda (D12/SACRO)	Pos. Derecha (D12/SACRO)	Flexión Lateral Izquierda	Criterio AMA	Flexión Lateral Derecha	Criterio AMA
1ª	5.8º / -2.4º	-20.4º / -5.5º	31.2º / 2.6º	23.0º	OK	20.0º	OK
2ª	5.6º / -1.9º	-21.9º / -6.1º	34.3º / 3.4º	23.0º	OK	23.0º	OK
3ª	5.7º / -1.3º	-23.5º / -5.7º	36.8º / 5.8º	24.0º	OK	23.0º	OK

Figure 3. Results recorded by each inclinometer (dual inclinometer technique) placed on T12 and the sacrum to assess the lateral flexion range of the lumbar spine. The measurement repeatability criterion is met (AMA criterion).

Therefore, the final result is as follows:

Valorar	Ver Pasivo	Amplitud máxima	PM frente referencia AMA	Criterio AMA
Flexión		25º	50%	✔
Extensión		5º	75%	✔
Flexión Lateral Izquierda		23º	22%	✔
Flexión Lateral Derecha		22º	27%	✔

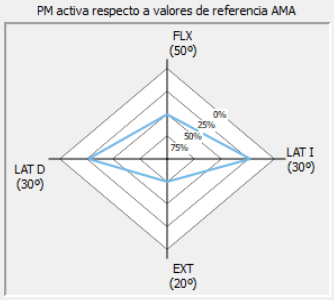

Figure 4. **Top**: Results of the maximum range of active motion of the lumbar spine and percentage of mobility loss or deficit (ML) in each test with respect to the reference values of the American Medical Association (AMA). **Bottom**: Comparison of the percentage of loss of active lumbar mobility with respect to the reference values of the American Medical Association (AMA) in each axis of movement assessed. The percentage of mobility loss is represented by the blue line.

QUESTIONS

Guided by the following questions, finish the interpretation of the results you obtained for the lumbar mobility assessment of this patient.

1. Were the records obtained valid in terms of repeatability?
2. Was a validity straight leg raising test necessary?
3. What was the maximum range recorded for each movement?
4. Is the mobility recorded for each axis considered as normal?
5. What values were taken as a reference for normality?
6. What is the most limited movement or with the greatest loss of mobility? And the least limited movement?
7. Is the loss of mobility recorded significant?
8. Were important asymmetries found in the laterality of the movements?