# P8 - EVALUATION OF THE ROTATIONAL STIFFNESS AND ELASTICITY OF THE LOW BACK AND IMPROVING THE LOW BACK DYSFUNCTION

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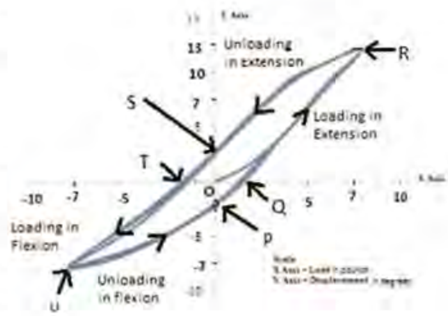
## Introduction

A nonlinear system can have a hysteretic response. Hysteresis occurs when the output response of a system lags behind the input stimulus. Hysteresis Loop Area (HLA) is enclosed by the curve QRTUQ. HLA measures the Dissipation of Energy. The greater the area, the less elastic (resilient) is the system. A perfectly elastic system has zero area. Stiffness is the load applied divided by the displacement produced. This concept is applied to the Low Back Tissues in this project.




## Purpose/Aim

To objectively evaluate the effect of frequency and amplitude of oscillations (applied to the right and left pelvis alternately) on the elasticity and stiffness of the low back.

## Material/ Methods

1. Baseline Evaluation Procedure: The subject lies supine on the Anatomic Torsion Monitor (ATM) (Warner 1997). The laser platform is strapped to the subject's ASIS. The laser pointer projects a dot on target which is set at zero degrees angular displacement with no weight on weight carriers. Initially, lever arms are without weight at zero angular displacement. Weights are added to the right lever arm weight carrier in five-pound increments up to twenty-five pounds. This causes the right pad to rise displacing the right PSIS anteriorly. The right ASIS also rises in response causing the projected dot on the target to move upward. Right lever arm applied weight and dot above the zero mark on the target are recorded as positive numbers. Angular displacement for each applied weight is read from the target by the operator.. Weights are removed from the lever arm weight carrier in 5-pound decrements. Angular displacement for each removed weight is read from the target through zero weight. The above steps are repeated for the left lever arm.
2. Providing Oscillations to the Low back. This figure shows a subject on the automated anatomical bending monitor (A-ATM). A cam mechanism and a DC motor were fitted to the ATM. The cam mechanism is attached to pneumatic cylinders that provide the oscillation alternately to both sides of the pelvis. The frequency of the oscillations is controlled by a speed controller switch.

**Procedure**

The patient lies spine on the A-ATM. Baseline hysteresis loops HLA are measured using the procedure described above. Oscillations are imparted alternately to each side of the pelvis. HLA are remeasured to compare the resilience, and stiffness of the low back before and after imparting oscillations.

**Results**

Ten subjects (9M, 1F) age 24-77 were given oscillation to the low back of 20 cycles per minute with amplitude of two inches for 5 minutes. HLA was measured before and after. For the 7 subjects with BMI <. 25, HLA decreased in every case by 64 + 26%; for the three subjects with BMI > 25, HLA increased in every case by 36 + 19% (Mean + SD). On a separate occasion, subjects received only 2 minutes of oscillation. HLA changes before and after were calculated but showed no consistent trend and are not reported here.

**Relevance**

Langevin (2011) found lumbar fascial thickness to be greater in persons with a history of low back pain. This project explores a method of both measuring and changing mechanical properties of the low back which may be useful in both evaluating and treating conditions of the low back.

**Conclusion**

Providing oscillations alternately to the right and the left pelvis for five minutes at a frequency of 20 cycles per minute results in improved elasticity of the low back for normal subjects whose BMI is 25 or less. An insignificant change in stiffness for all the subjects was observed.

**Discussion**

Five minutes mechanical oscillation can have an effect on the mechanical properties of the low back. This duration could be achieved in a clinical treatment program. For clinical application to low back injury the displacement, amplitude, frequency, and duration of treatment will probably depend additionally upon an individual's medical and physical conditions as well as BMI.

**References**

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