Objective measurements of the pressures applied to the scoliotic body, due to increasing straps tension in Rigo-Cheneau braces and how this affects the scoliosis correction.

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Mechanical & Robotics Engineer How can we understand if,

the Rigo-Cheneau scoliosis brace we have applied,

is working and we get all of its capabilities?

## Fact

#### Tighten the straps increases the pressure to the body



But how much pressure we must apply? and how we can we perceive it?





### Testing by hand?





#### With the in-brace X-rays efficacy of the brace?





Some points of the brace exercise the maximum pressure to the scoliotic body, like for example at the thoracic or the lumbar hump.



For clarify the average pressure, in these points, we have decided to check them digitally.

# 51 patients fitted with Rigo Cheneau Brace

- Schildren (average Age: 8.6 y Riser 0)
- 36 Adolescents (average Age: 14.9 y, Riser 2)
  - 6 Adults (average age: 37.3)







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# Increasing Straps tension by 0.5 mm every day









#### Main Unit

A portable, light weight, battery operated, electronic medical data acquisition system of small size (5X5 cm), consisting of a microprocessor, with RAM and integrated circuits, with a microSD card and a Li-Ion battery 4.5 Volts

#### Force sensors

3 square shaped pieces, 36 cm<sup>2</sup> (6cm X 6cm)



Control Unit

A handheld monitor controller.



#### All patients were checked:

In the 1<sup>st</sup> control by:

Formetric 4D

X-rays

in the 2<sup>nd</sup> control

Formetric 4D

In-brace X-rays

Aesthetic evaluation.



# **RESULTS & DISCUSSION**



# patients follow all the instructions to increase the straps tightening about **0.5 millimeter every day**





patients did not follow our instructions for straps increasing tension and have been excluded. It was performed in all patients:

#### Formetric 4D, in-brace X-rays and Aesthetic evaluation

#### Children



## Adolescents



## Adults



The Children's pressure measured was an average of 1.083 kg



The difference between the two controls was 0.074 kg

The Adolescent's pressure measured was an average of 1.540 kg



The difference between the two controls was 0.185 kg

The Adult's pressure measured was an average of 1.881 kg







#### The difference between the two controls was **0.068** kg



The children's pressure measured was of an average of **1.083** kg, the adolescent's **1.540** kg and the adults **1.881** kg

#### speculative answer

We presume that this difference was due to the elasticity of the tissues and bones in Children.

More stiff is the trunk such more pressure needs to be applied.

### Findings

After increasing the straps tension of **0.5 mm** every day, was measured almost the same pressure with a difference less of **0.185** kg of the first control, even if the straps were shorter by almost **4.5** cm.

#### speculative answer

Increasing the straps tension seems to affects the rotational effect of the brace and consequently the Cobb angle

# CONCLUSION

# It seems that at Rigo Cheneau brace, tightening of the straps

is

# proportional of the rotation and

the in-brace X-Ray correction

# Gradually tightening the straps

## more correction we achieve

We believe that the 0.5 mm/day is enough for succeeding the right pressure.

# But at this point rising 2 questions:

1. How can we record it?

2. How many millimeters we must add after the first application



# We have establish a pressure system control for scoliosis braces

with calibrated straps



for more accurate and non-empirical adjustment of the brace.

2. How many millimeters we must add after the first application

# The 1<sup>st</sup> speculative answer is that:

we can add such millimeters as the patient can withstand.

The increasing of 0.5 mm per day is something which cannot be perceived by the patient, but cumulatively reaches 1.5 cm in a month and 4.5 cm in 3 months. 2. How many millimeters we must add after the first application

## The 2<sup>nd</sup> speculative answer is:

# depending of the Cobb angle.

Greater is the Cobb angle more pressure must be exercised over time.

# Thank you for your attention