

The logo for SIGVARIS, consisting of the word "SIGVARIS" in white, uppercase, sans-serif font, centered within a dark blue square background.

**ICC meeting 2013 –  
STIFFNESS ISSUE  
Statement of SIGVARIS-FRANCE**

**B Lun<sup>1</sup> , A Lançon<sup>2</sup> , D Sion<sup>2</sup>**

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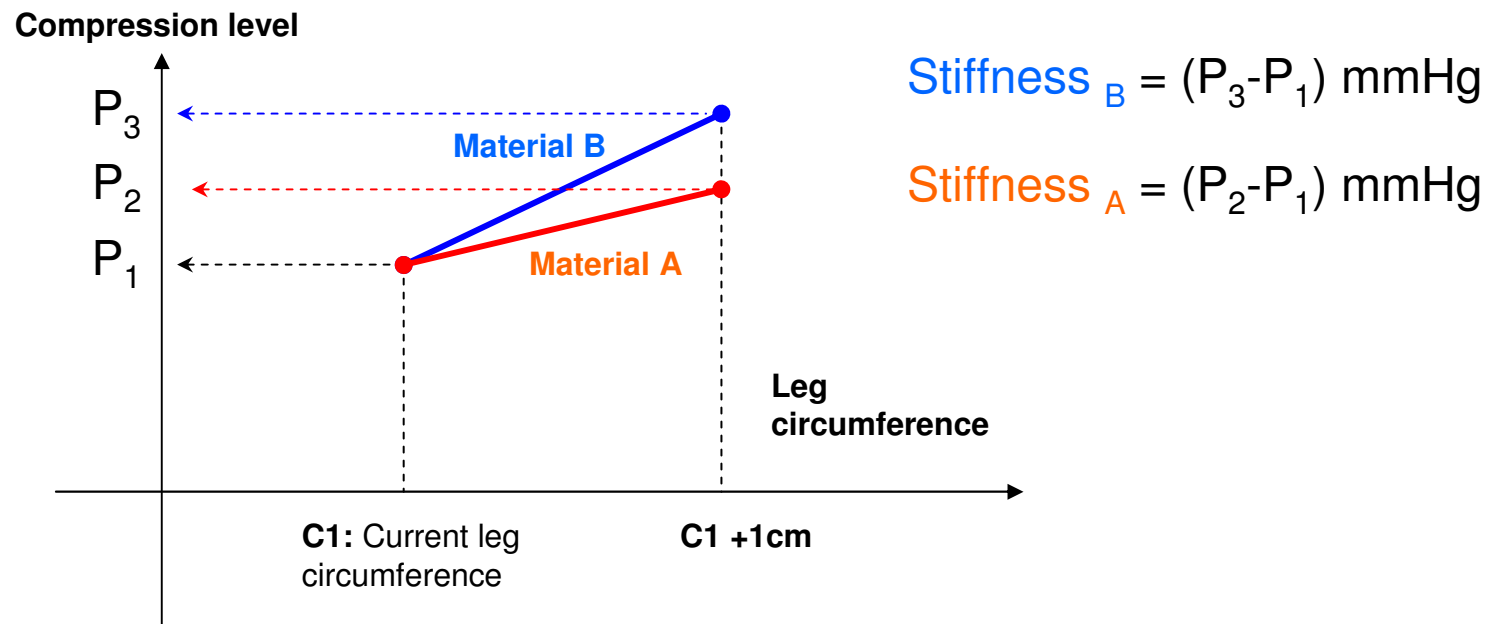
**STIFFNESS – ICC 2013**  
**Statement of SIGVARIS FRANCE**

1. Stiffness definition.
2. Physics of Compression and Stiffness.
3. Evaluation of Compression and Stiffness.
4. Consequences in the product portofolio
5. Position of SIGVARIS - FRANCE

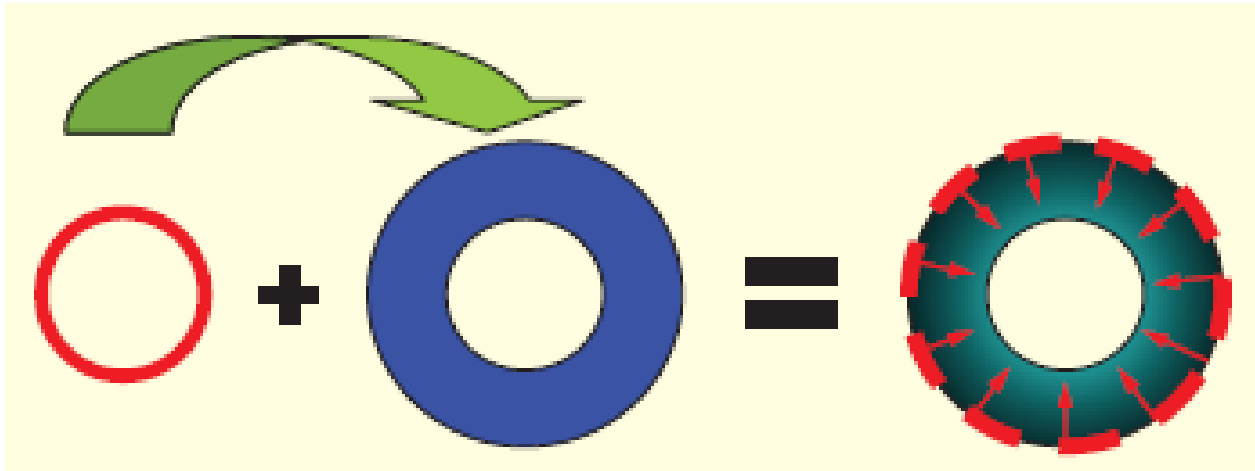
## STIFFNESS DEFINITION

from ICC consensus 2006

Stiffness is the increase of compression per cm increase in the circumference of the leg, expressed in hPa/cm and/or in mmHg/cm



# Physics of Compression & Stiffness

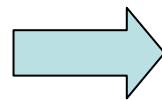


Elastic / Extensible  
material

Body

Compressed body

Laplace's law

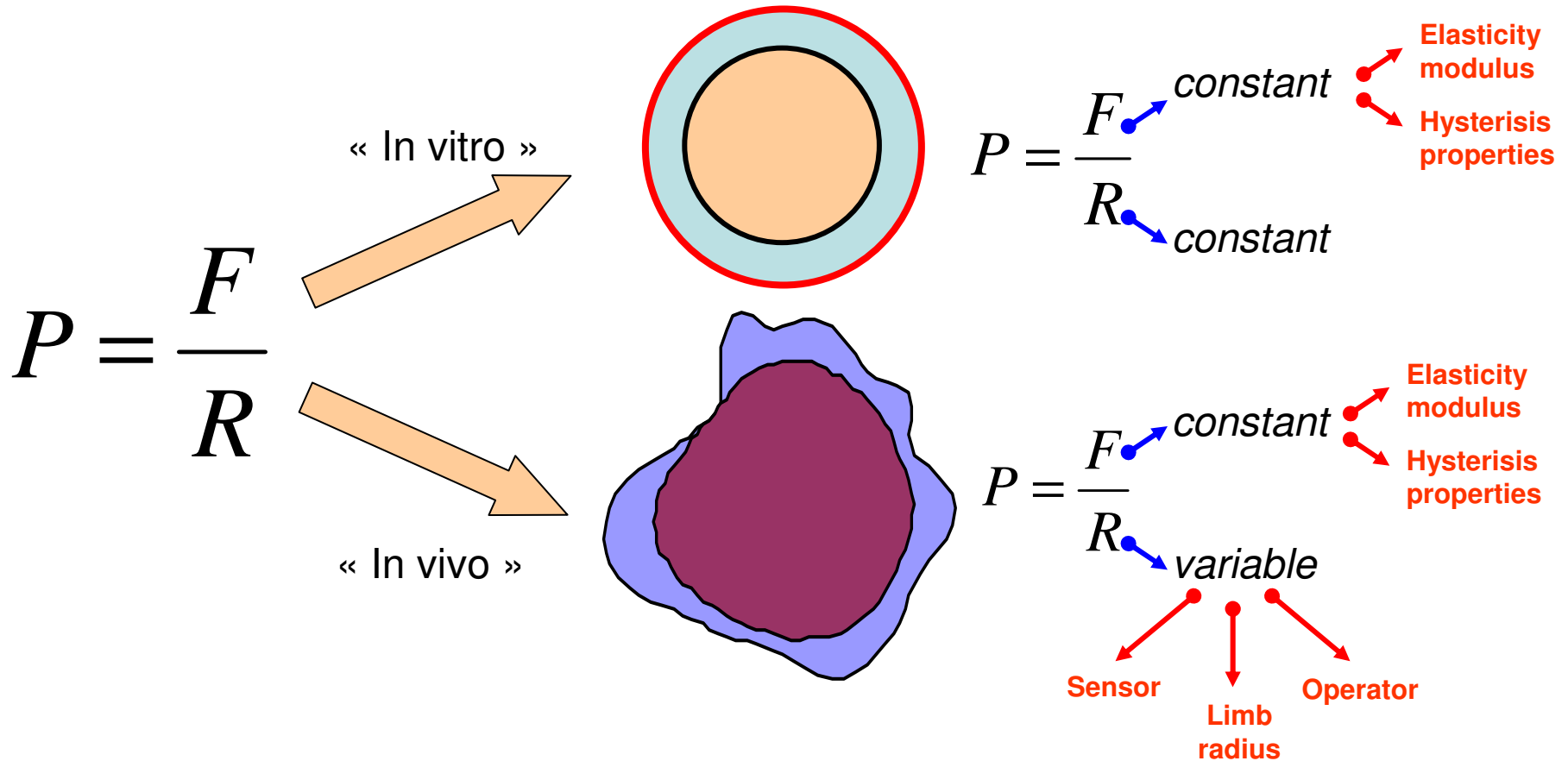


$$P = \frac{F}{R}$$

LAPLACIAN PRESSURE

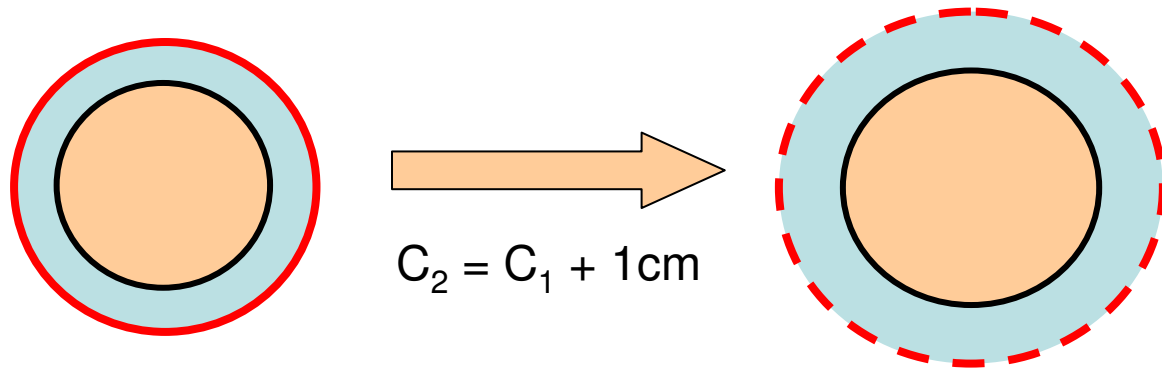


# Physics of Compression & Stiffness

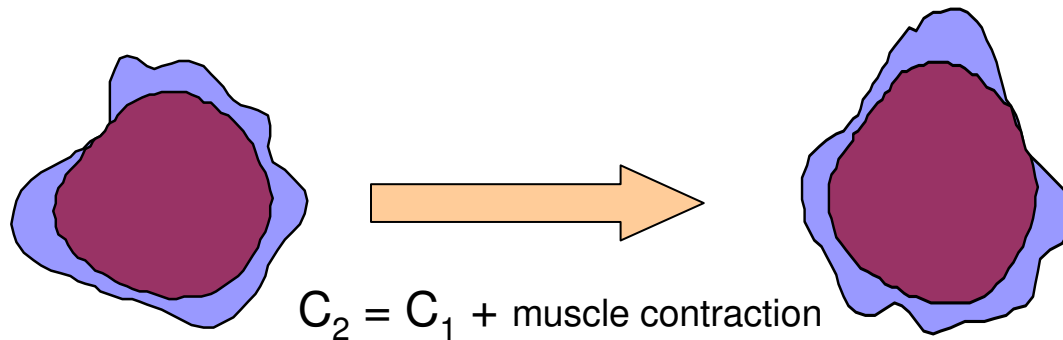


# Evaluations of Compression & Stiffness

« In vitro »



« In vivo »



Circular model Vs Morphological shape

## Evaluations of Compression & Stiffness

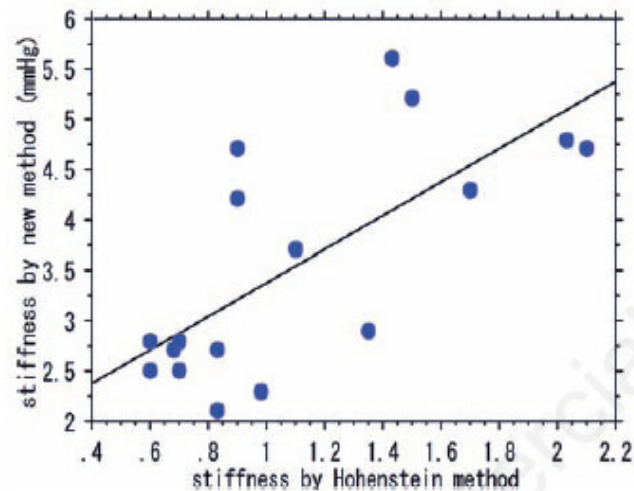


Figure 6. Correlation of stiffness measured by the Hohenstein method (x-axis) and by the mannequin-leg (y-axis) in 17 stockings (AMI-3037<sup>®</sup>).

### Correlation Stiffness SSI

### Circular model Vs morpho model

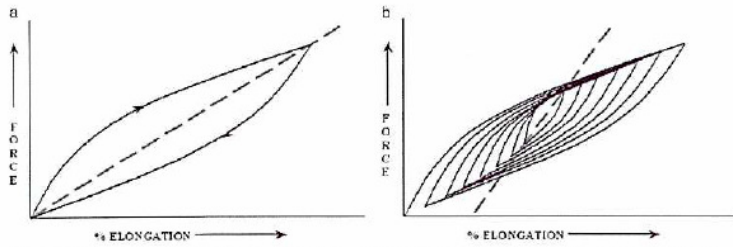
**The Mannequin-leg:  
a new instrument to asses  
stiffness of compression  
materials**

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Hospital, Nagoya, Japan; <sup>2</sup>Private prac-  
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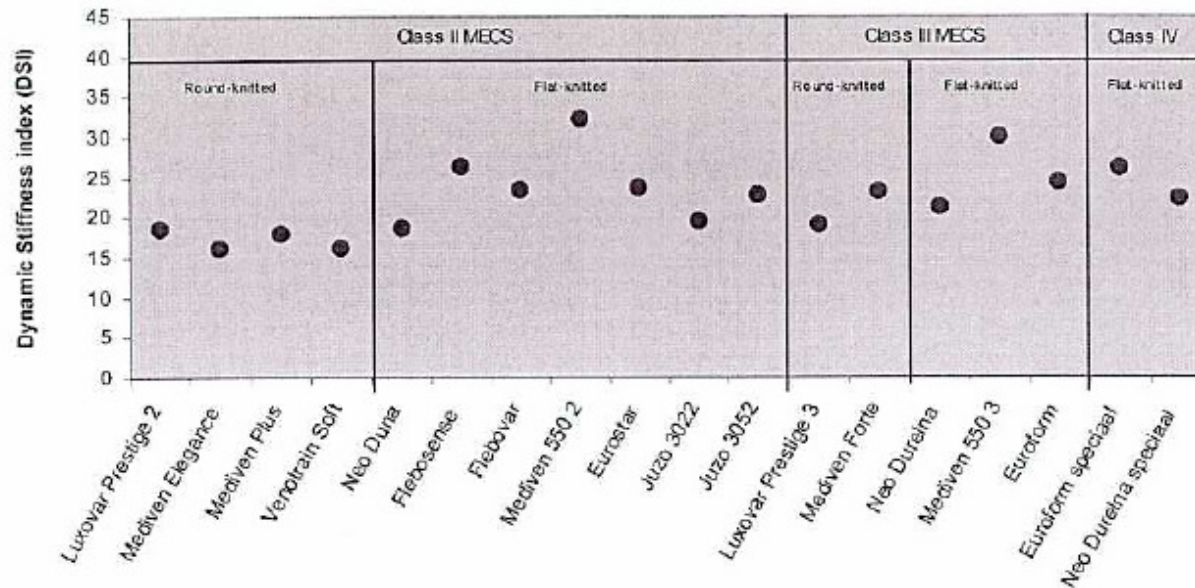
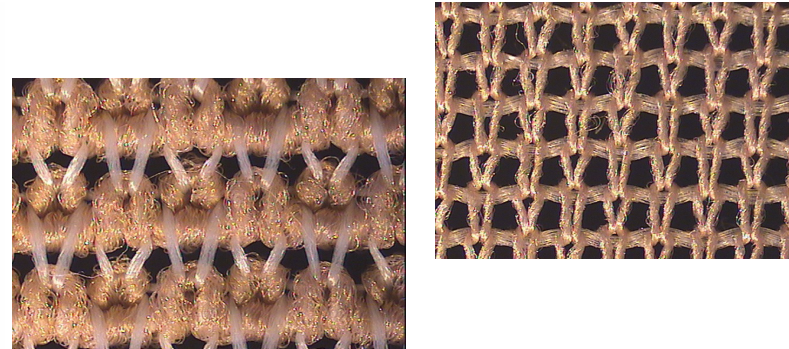
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*Veins and Lymphatics* 2013; 2:e3  
doi:10.4081/vl.2013.e3

Statement of SIGVARIS FRANCE

Textile construction and DSI



**Figure 1** Static and dynamic force elongation curves of MECS. The slope of the curve resembles the stiffness. (a) Under semi-static conditions the MECS is elongated from a state of total relaxation to the stretch that is required at the B1 level. (b) Under dynamic conditions as during walking the circumference changes of the leg are small. This curve shows the smaller the elongation increments, the steeper the curve meaning a higher dynamic stiffness index



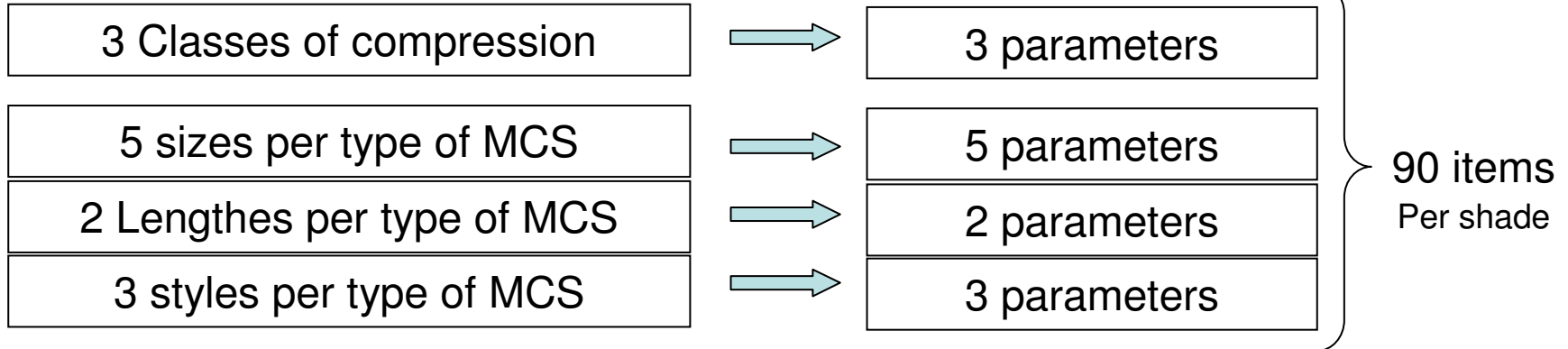
**Figure 6** Distribution of dynamic stiffness index of 18 different brands of class II, class III MECS. Each dot represents one MECS



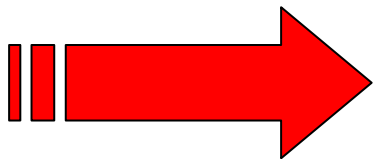
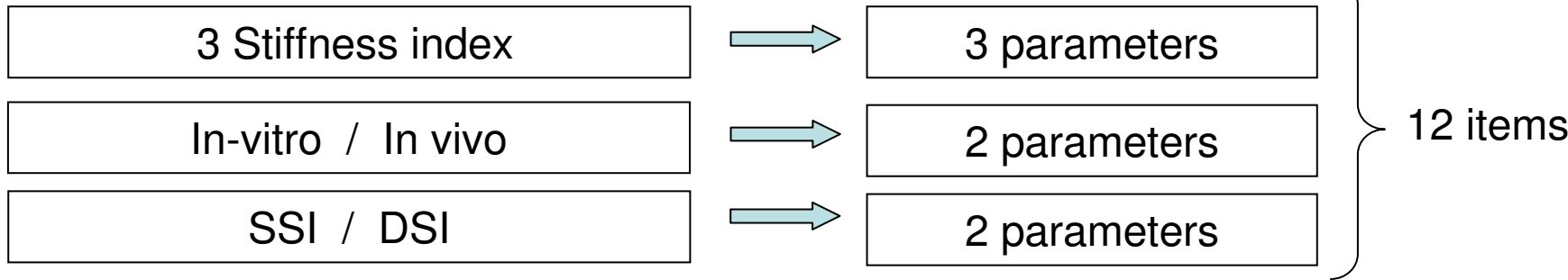


Consequences in the product portofolio

Current status



New additional properties



$90 \times 12 = 918$  items per color

## Benefits of Stiffness

### Is low compression pressure able to improve venous pumping function in patients with venous insufficiency?

*Results:* EF was significantly reduced compared with healthy controls. Compression stockings exerting a median pressure of 27 mmHg (interquartile range [IQR] 25–29) in the supine and 30.5 mmHg (IQR 28.25–34.25) in the standing position produced a moderate, non-significant improvement of EF of 17%. Inelastic bandages with a resting pressure of 20.5 mmHg (IQR 20–22) in the supine position resulting in a standing pressure of 36 mmHg (IQR 33–40.75) led to a significant increase of EF of 61.5% ( $P < 0.01$ ). A further increase of the resting pressure to 40 and 60 mmHg achieved an increase of the EF of 91% and 98%, respectively ( $P < 0.001$ ).

*Conclusions:* In patients with venous pumping failure, inelastic bandages produce a significant pressure-dependent increase of EF. A significant improvement in venous pumping function was achieved with inelastic bandages even at a resting pressure of 20 mmHg.



Link between  
Stiffness and Ejection Fraction

Size considerations

SSI of size XS

≠

SSI of size XXL

SSI at B point

≠

SSI at B1 point

≠

SSI at C point

What is the most relevant point to evaluate the SSI ?

What is the most relevant point to evaluate the DSI ?

**STIFFNESS – ICC 2013**  
**Statement of SIGVARIS FRANCE**

**POSITION of SIGVARIS – France**  
**At ICC meeting 2013**

1. To-day Stiffness measurement has no standard. It could not be introduced as a MCS textile construction parameter  
Stiffness index is an interesting scientific subject.
2. It is premature to officialize consensus as each method and instrument provides their specific figures.
3. We support the idea to conduct more investigations.
4. **We are strongly against the idea of stipulating the Stiffness index on the commercial box**

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**OK for range**

<b>Class ("Range"?)</b>	<b>Pressure in mmHg</b>	<b>Level of Compression</b>
I	15-20	Mild
II	20-30	Moderate
III	30-40	Strong
IV	>40	Very strong

No qualifier

No qualifier

**"The aim of a MCS is to provide compression, therefore pressure will still be the only right, relevant and appropriate unit to be used"**