ARE ADJUSTABLE WHEELCHAIR CUSHIONS BETTER?

PRESENTED BY

Tom Whelan

V. P. Product Development

Ki Mobility by Etac

SESSION OBJECTIVES

- Explain the various methods of pressure redistribution in wheelchair cushions and how they could affect pressure values at specific points.
- Explain how viscosity in wheelchair cushions may affect stability.
- Explain the importance of being able to adjust the fluid volume of a wheelchair cushion ‘in the field’ during an initial fitting or a follow-up with a user.

ARE ADJUSTABLE WHEELCHAIR CUSHIONS BETTER?

Many hold the thought that high end air cell cushions are the best for tissue integrity.

Why is that thought so prevalent?

ARE ADJUSTABLE WHEELCHAIR CUSHIONS BETTER?

Many hold the thought that high end air cell cushions are the best for tissue integrity.

Why is that thought so prevalent?

Is it its adjustability?

ARE ADJUSTABLE WHEELCHAIR CUSHIONS BETTER?

Many hold the thought that high end air cell cushions are the best for tissue integrity.

Why is that thought so prevalent?

Is it its adjustability?

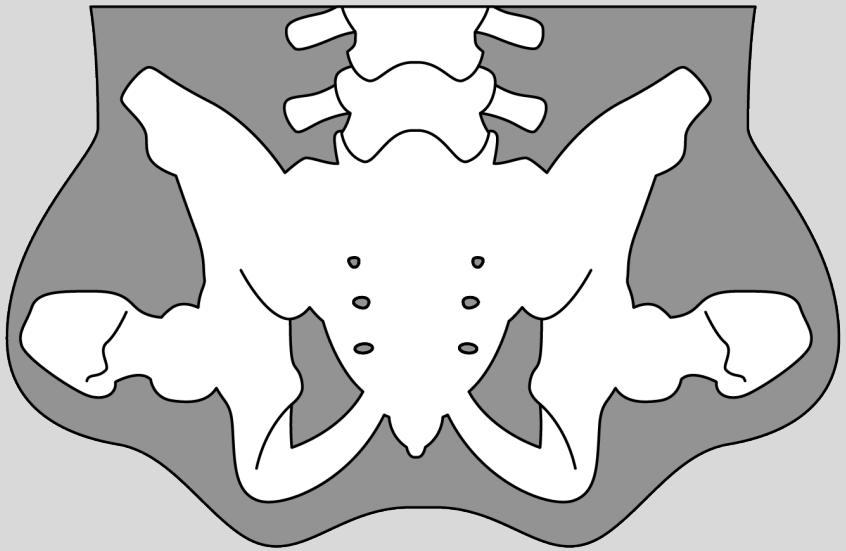
Is adjustability only possible in high end air cell cushions?

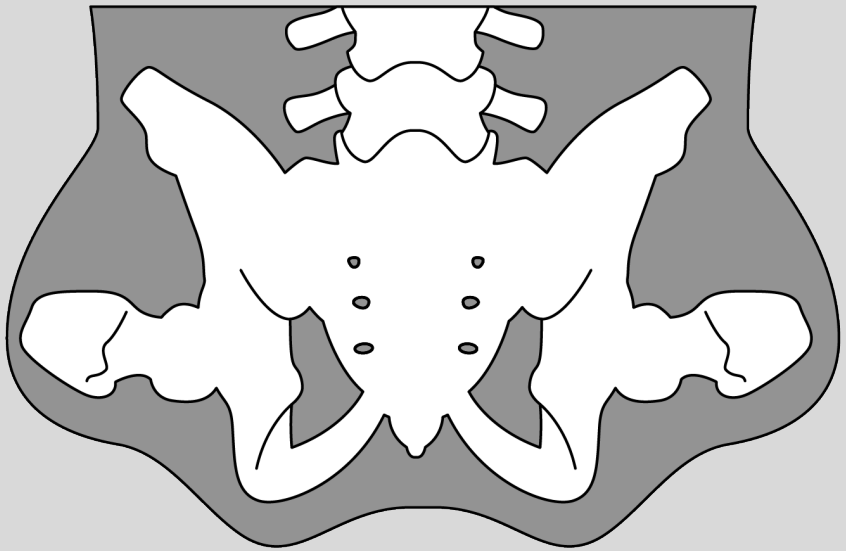
Science of Interaction

Push squishy clay into a rigid mold….

it takes the shape of the mold

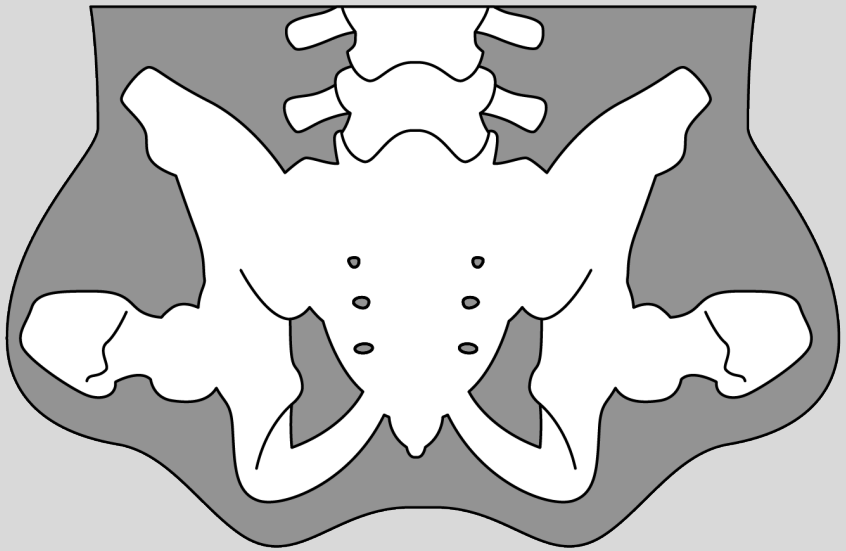
Unloaded Shape - - Squishy Soft Tissue

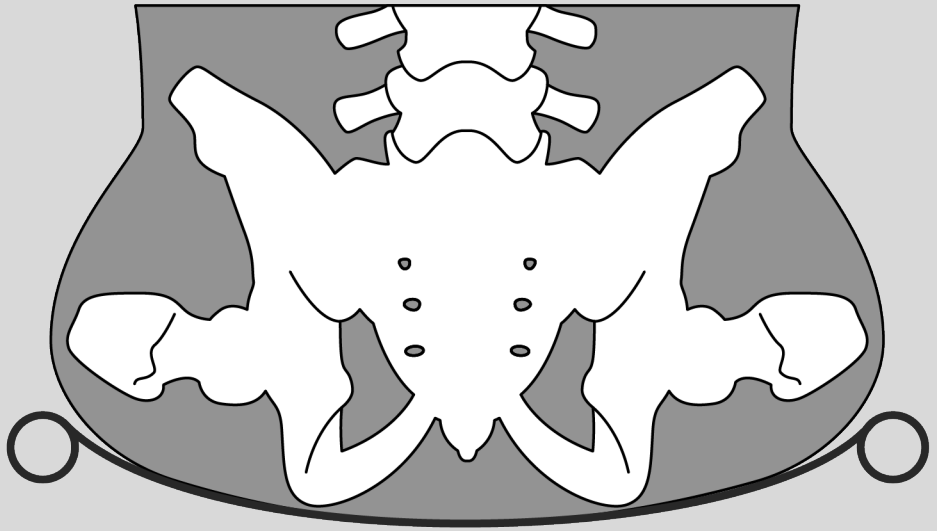




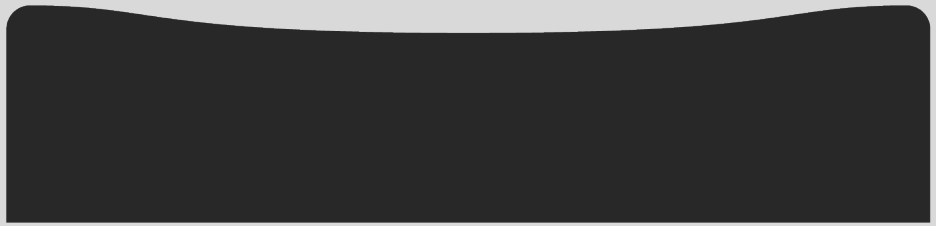
Mold

SCIENCE OF INTERACTION

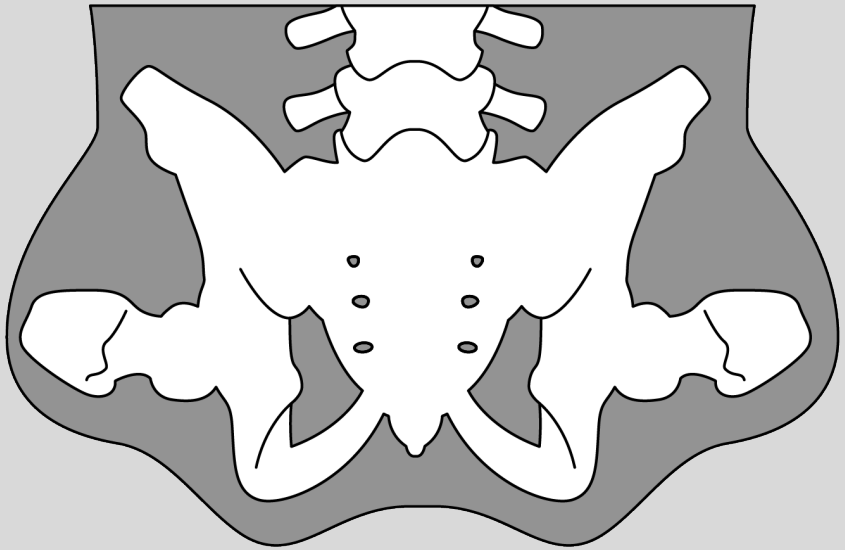


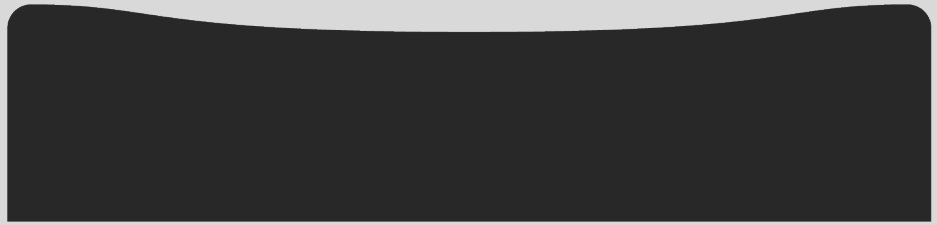


Mold made of Foam

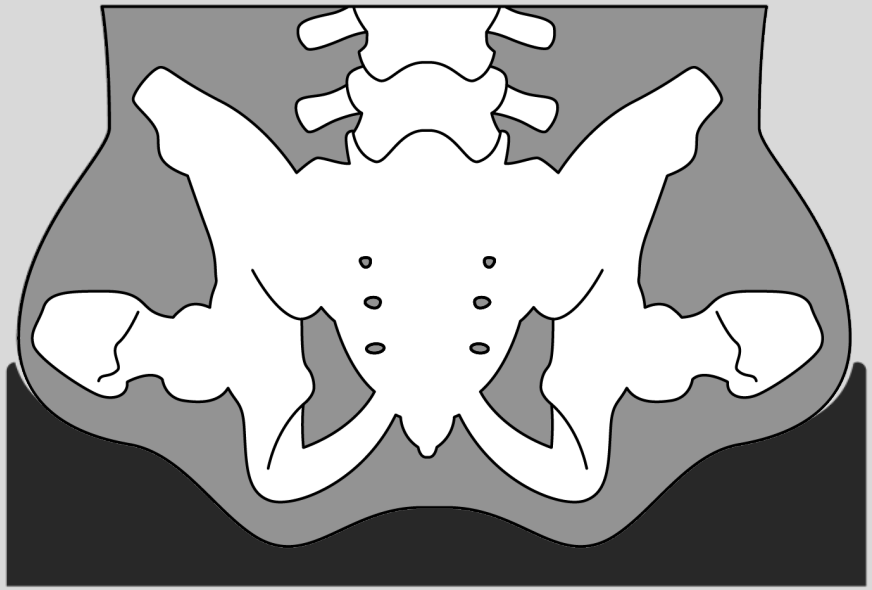


When an individual and a cushion meet. . .

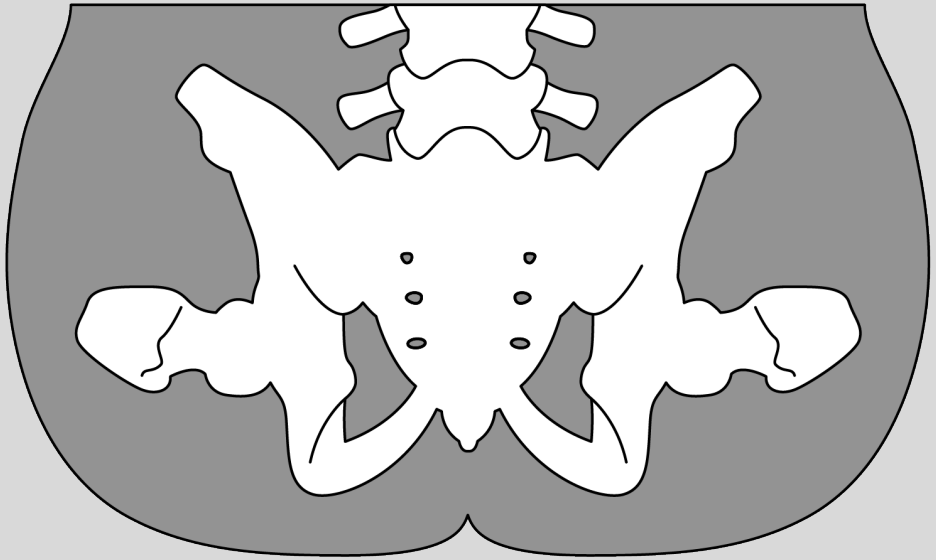


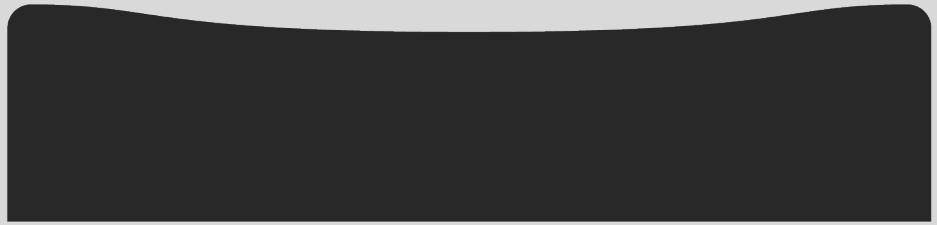


It results in a Unique Loaded Contour shape

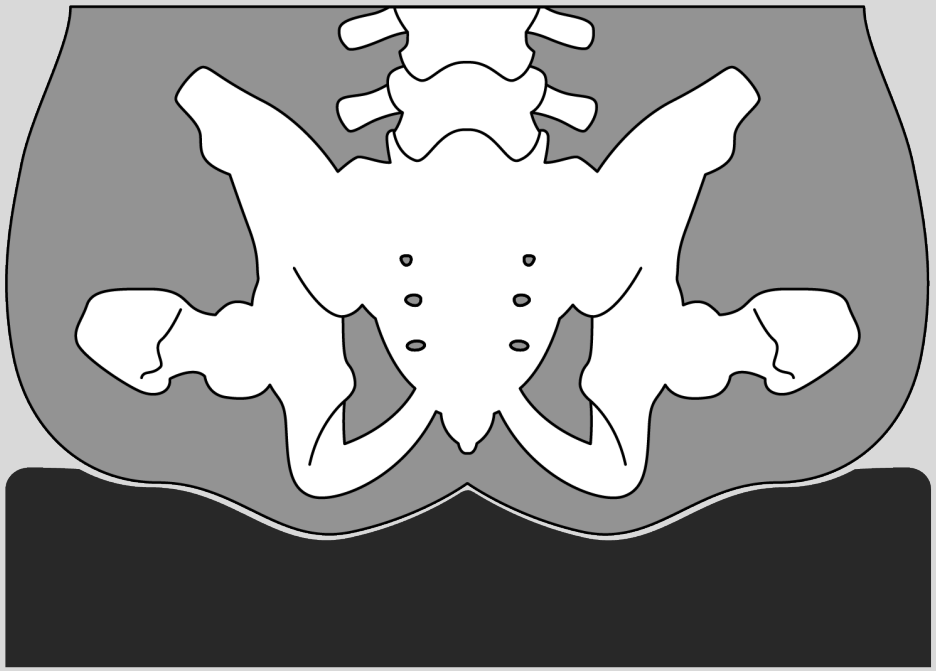


If a different individual meets that same cushion. . .



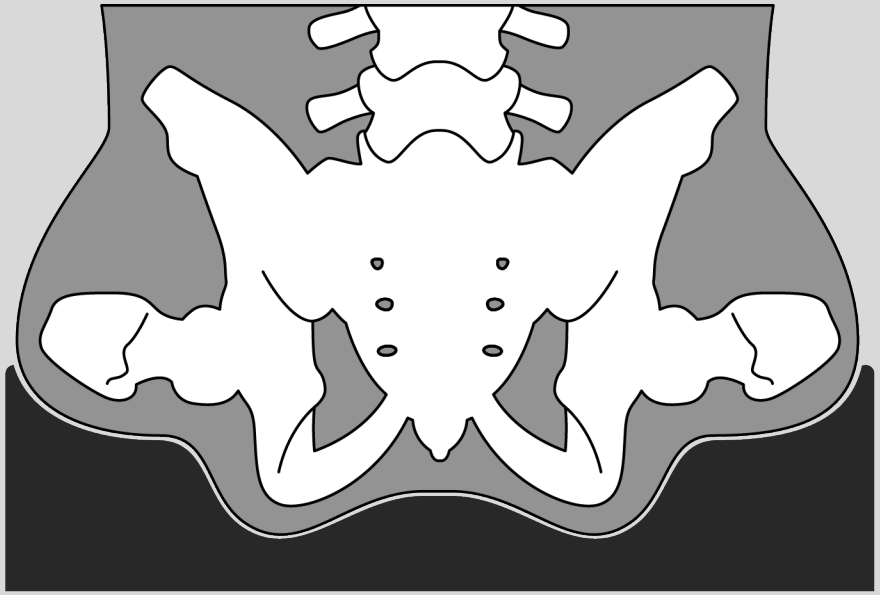


It will result in yet a different Unique Loaded Contour shape



Change a Characteristic of the Foam Mold, Introduce a Different Cushion. . .

It will once again result in a different Unique Loaded Contour shape

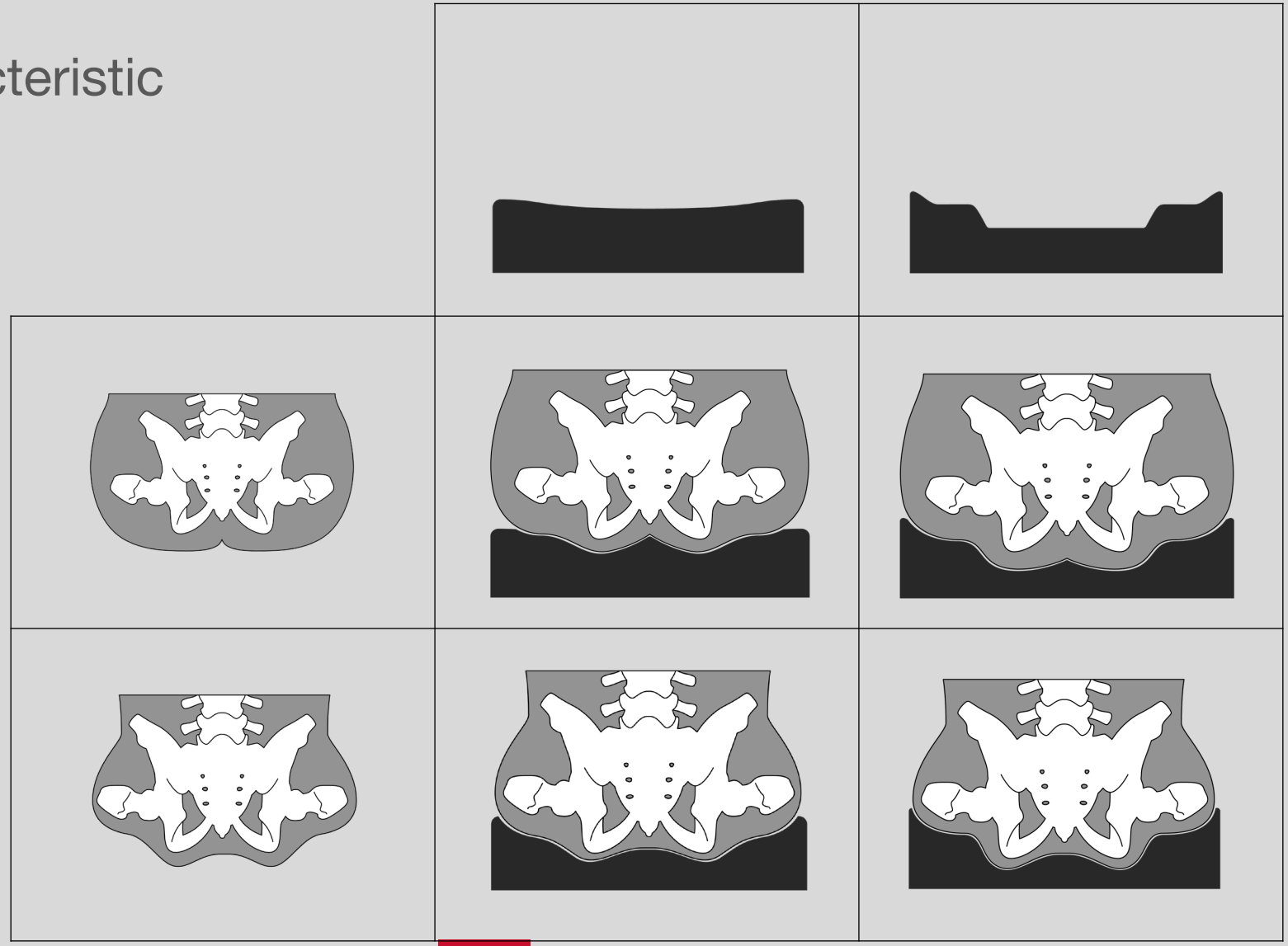


EVERY INTERACTION RESULTS IN A UNIQUE LOADED CONTOUR SHAPE

Change any characteristic
Of either element –

The body
or
The cushion

And you get a
Unique result



Why is every interaction different? Why does it happen?

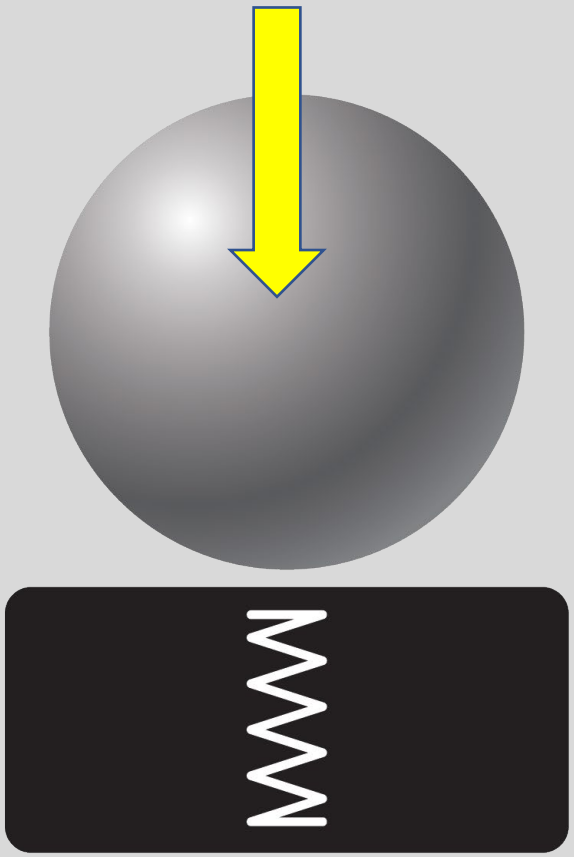
We know every individual is different,

But so is every cushion.

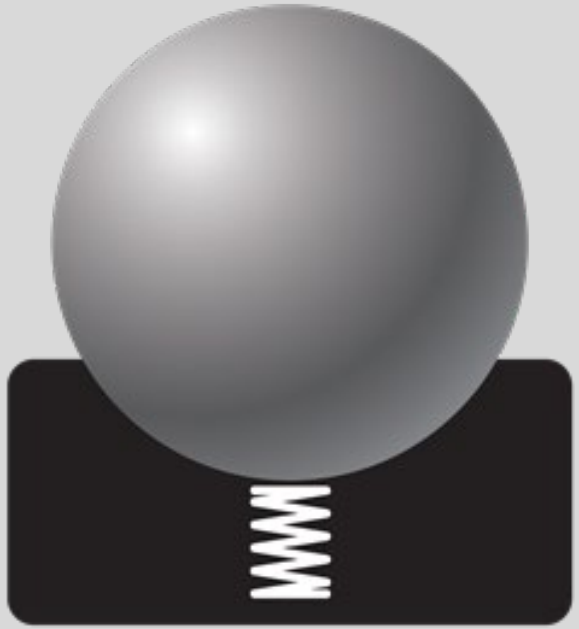
Let's understand the nature of the cushions

There are two primary types of cushion materials. . .

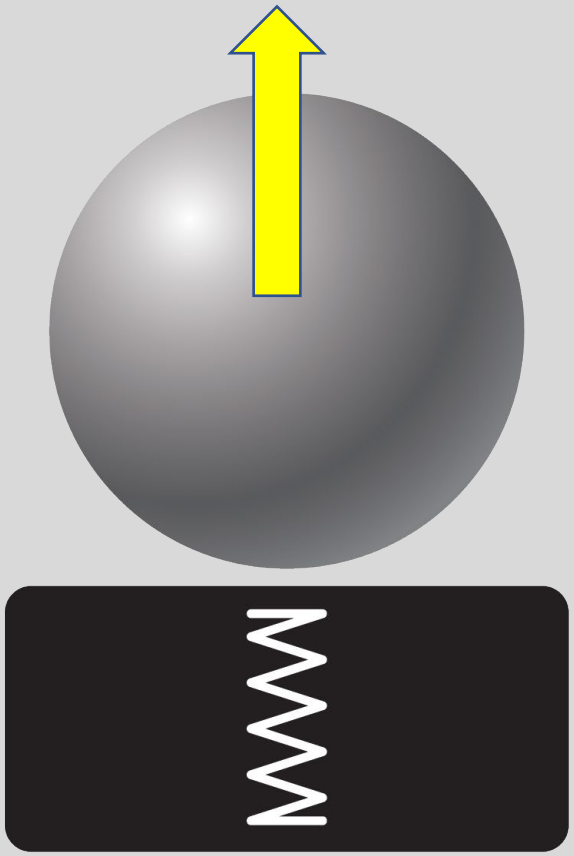
Compressible Materials



Compressible Materials



Compressible Materials



SCIENCE OF INTERACTION

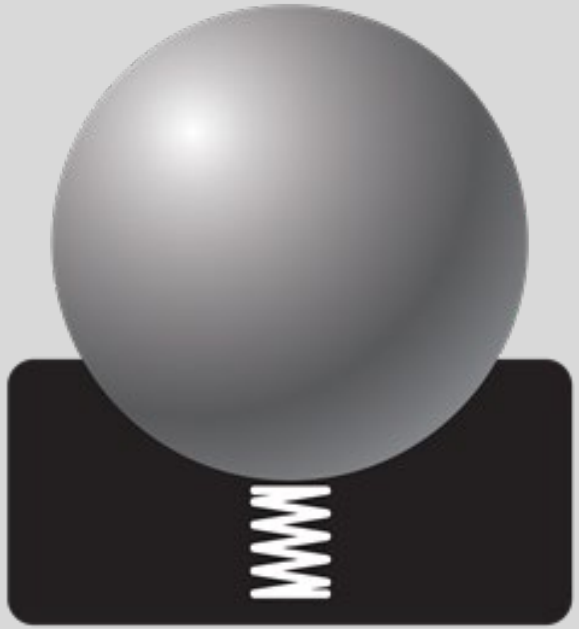
How do compressible materials interact with the body?

When we looked at the 4 body / cushion interactions,
Each one was different

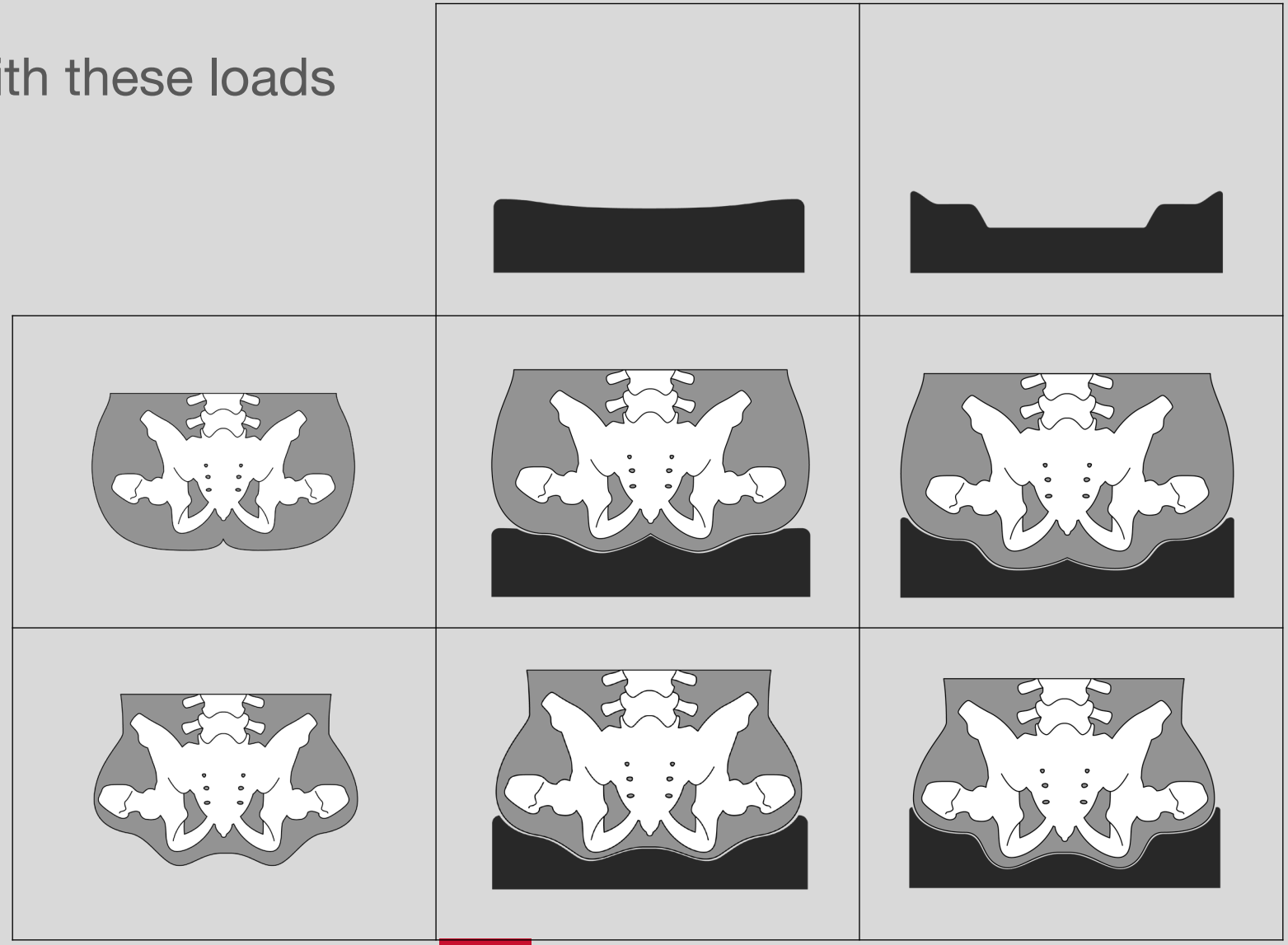
Why is each one different?

Compression's Effect on loaded contour shape

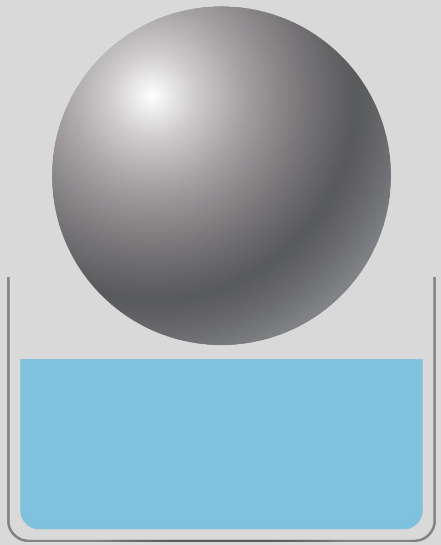
- Different loads, and shapes of those loads can yield different results
- Different foams can also yield different results

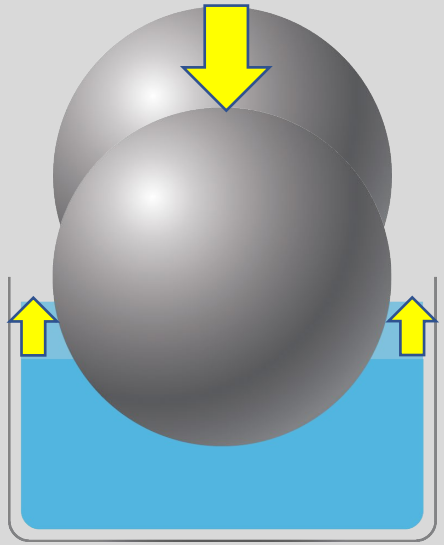


Just like we saw with these loads and ‘foams’

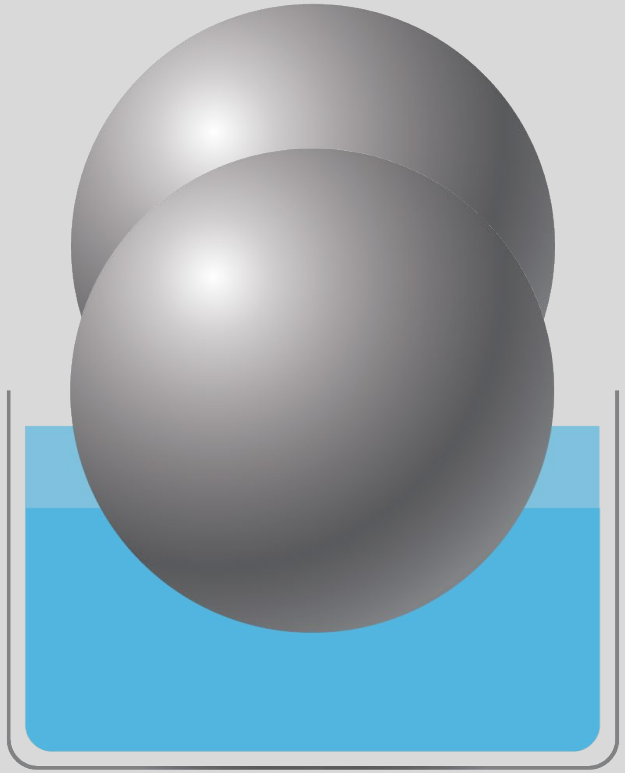


Displaceable Materials





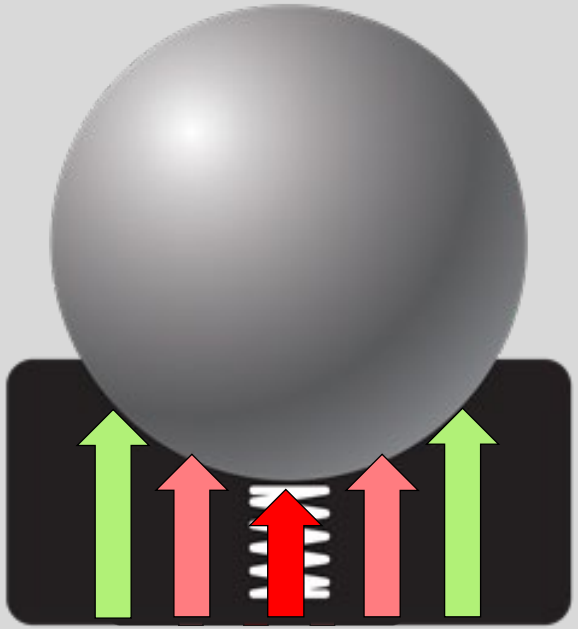
How do displaceable materials interact with the body?

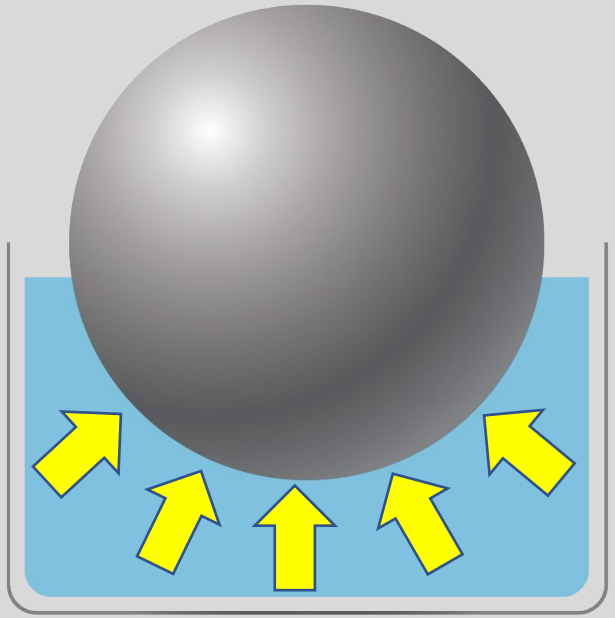


Compression vs Displacement – How Do They Compare?

Displacement is better than compression

- **Reaction Force**

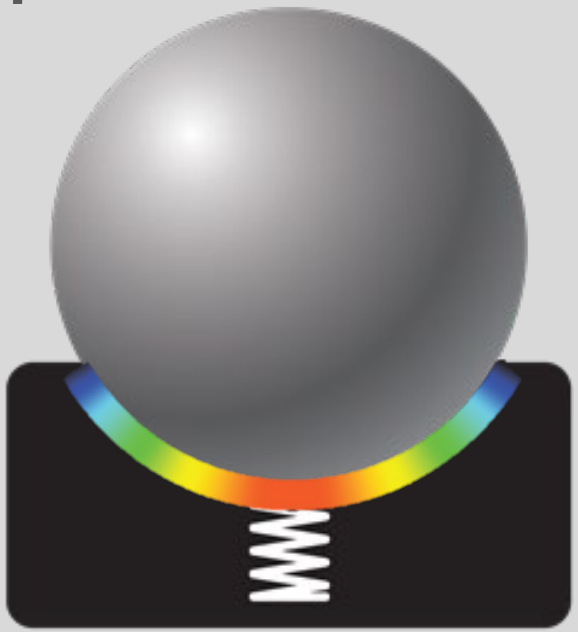


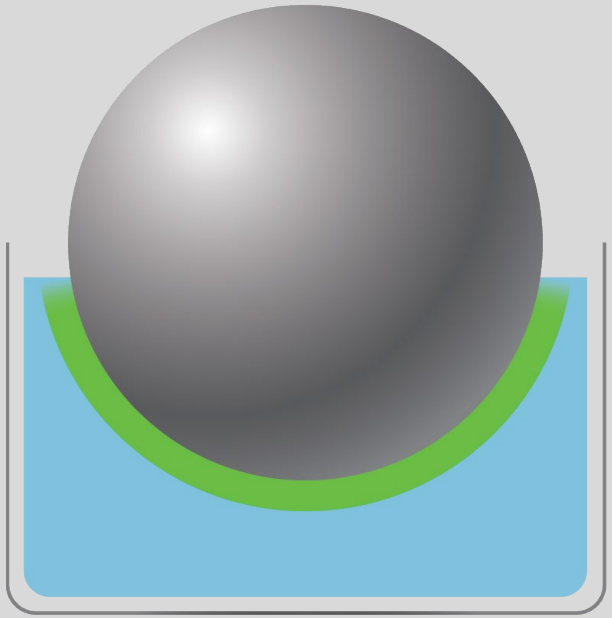


Compression vs Displacement – How Do They Compare?

Displacement is better than compression

- **Envelopment**





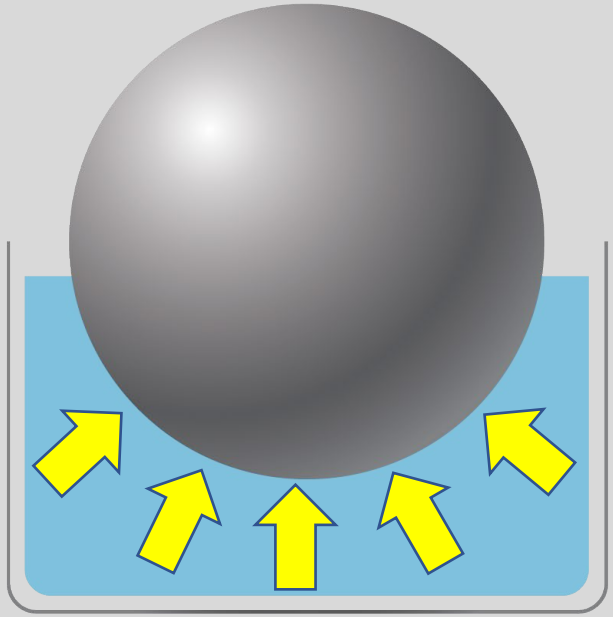
SCIENCE OF INTERACTION

Every Interaction is Unique

Just as we said with foam, every interaction between an individual and a cushion –

Whether that cushion is Foam, or Fluid

Will result in a unique loaded contour shape



WHAT'S HAPPENING IN THE INTERACTION?

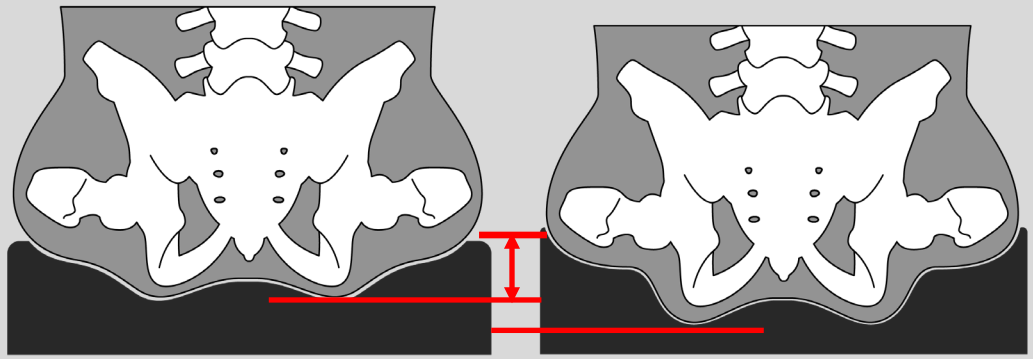
WHAT'S HAPPENING IN THE INTERACTION?

Before we look at some examples of interactions, let's remind ourselves of some important principles in the interaction

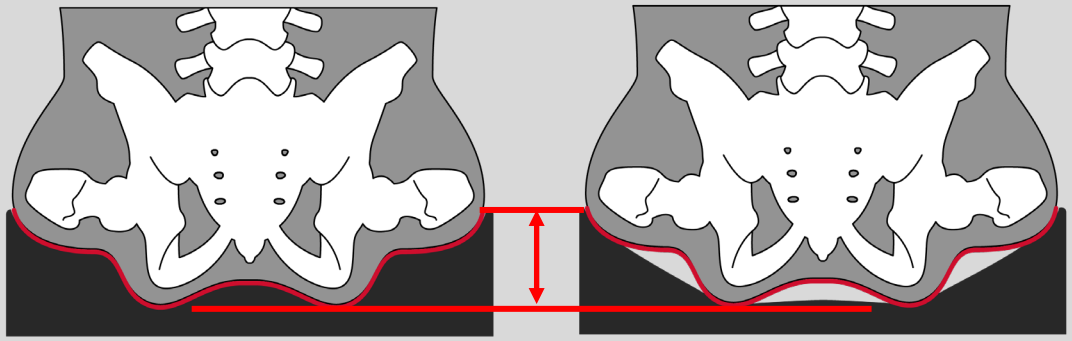
Immersion and Envelopment

Immersion and Envelopment in a wheelchair cushion

Immersion



Envelopment

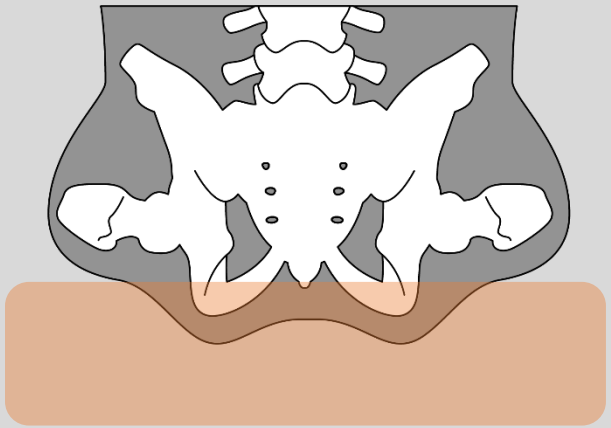


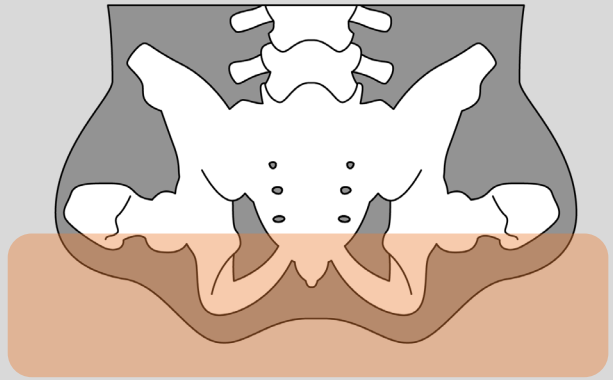
WHAT'S HAPPENING IN THE INTERACTION?

Envelopment is related to Immersion, as well as characteristics of the material being immersed into

Immersion can present more surface area to support

Envelopment can more fully utilize that available surface area



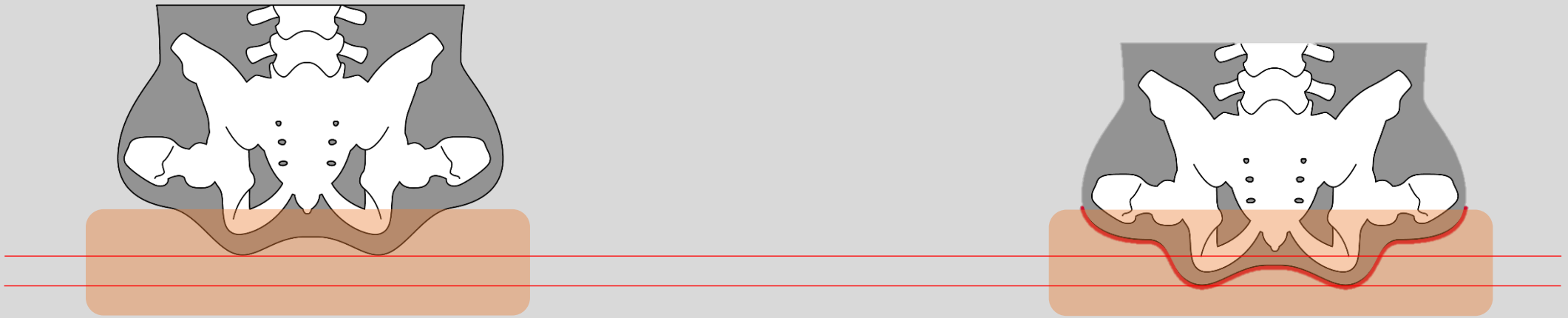


WHAT'S HAPPENING IN THE INTERACTION?

Envelopment is related to Immersion, as well as characteristics of the material being immersed into

Immersion can present more surface area to support

Envelopment can more fully utilize that available surface area



WHAT'S HAPPENING IN THE INTERACTION?

So, we've discussed the science of compressible materials and displaceable fluids

Now let's look at an example of a displaceable fluid used in the world of Wheelchair Cushions:

WHAT'S HAPPENING IN THE INTERACTION?

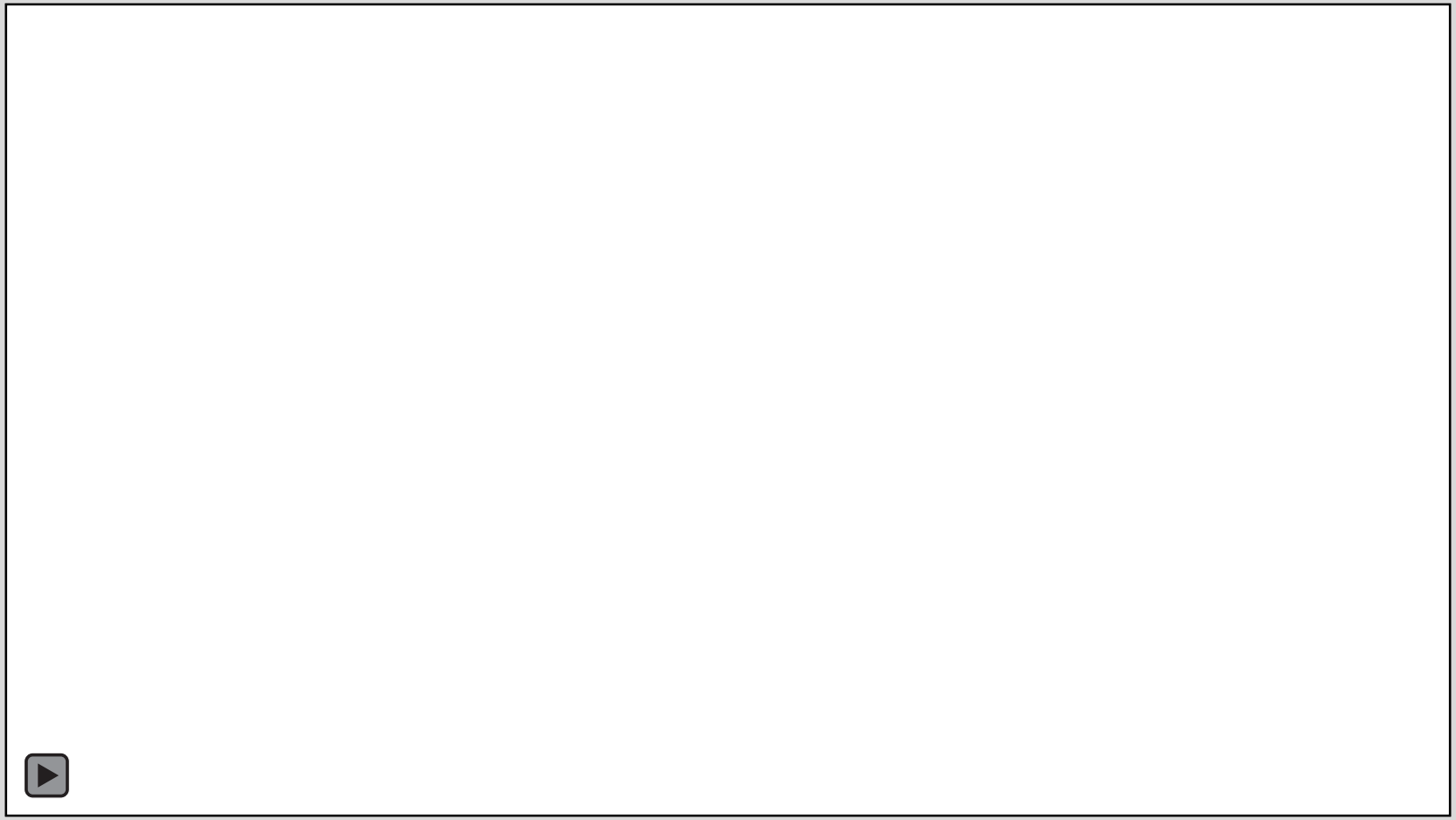
So, we've discussed the science of compressible materials and displaceable fluids

Now let's look at an example of a displaceable fluid used in the world of Wheelchair Cushions:

Air

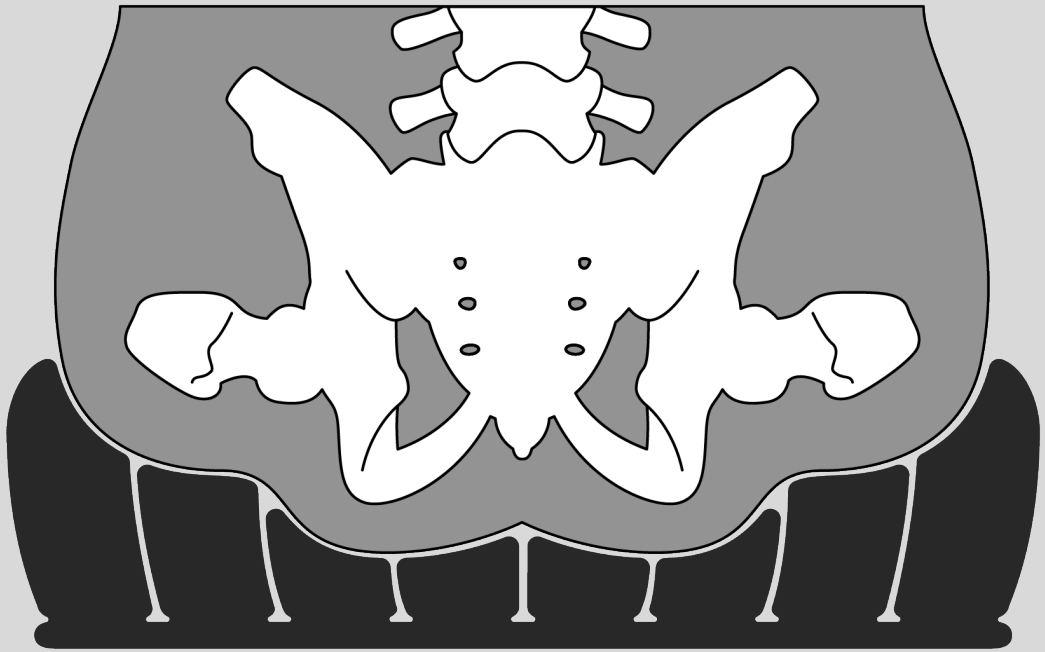
WHAT'S HAPPENING IN THE INTERACTION?

Displaceable Fluid - Air



WHAT'S HAPPENING IN THE INTERACTION?

Displaceable Fluid - Air



WHAT'S HAPPENING IN THE INTERACTION?

Let's look at a simulated load on some cushions, using two different indenters

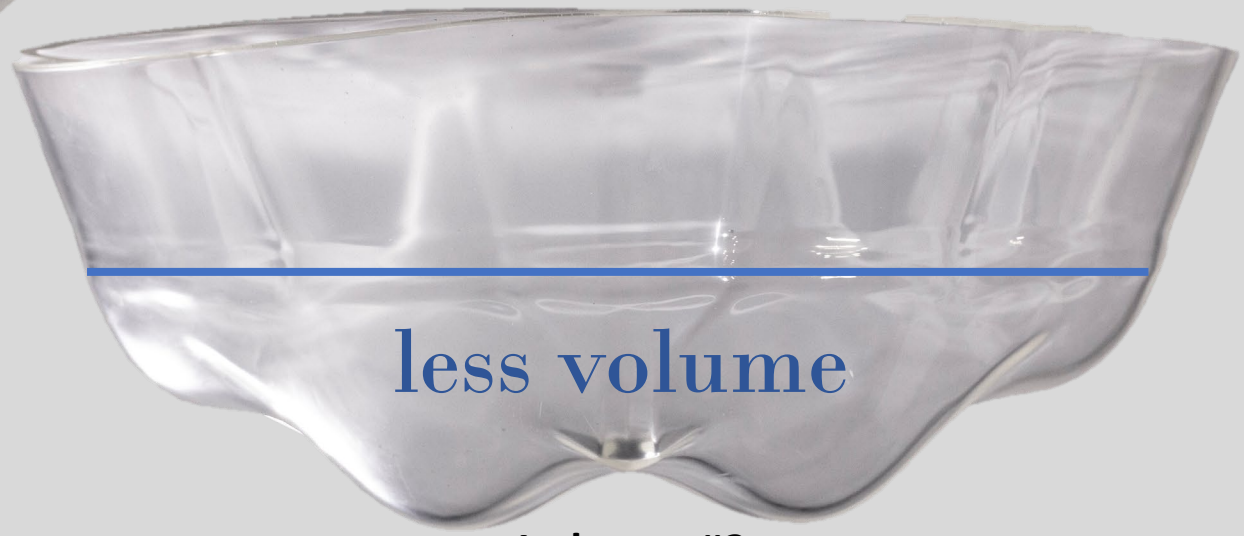
Indenter #1
CVA

Indenter #2
SCI

WHAT'S HAPPENING IN THE INTERACTION?

Let's look at a simulated load on some cushions, using two different indenters

Indenter #1
CVA



Indenter #2
SCI

WHAT'S HAPPENING IN THE INTERACTION?

Now, let's look at a different type of fluid

WHAT'S HAPPENING IN THE INTERACTION?

Now, let's look at a different type of fluid

Engineered Fluid

WHAT'S HAPPENING IN THE INTERACTION?

Now, let's look at a different type of fluid

Engineered Fluid

WHAT'S HAPPENING IN THE INTERACTION?

Engineered Fluid

Indenter #1
CVA

Indenter #2
SCI

WHAT'S HAPPENING IN THE INTERACTION?

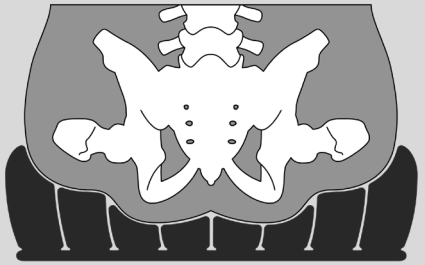
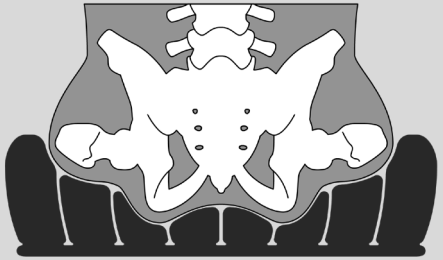
Engineered Fluid

Indenter #1
CVA

Indenter #2
SCI

DIFFERENCE IN IMMERSION AND SUPPORT

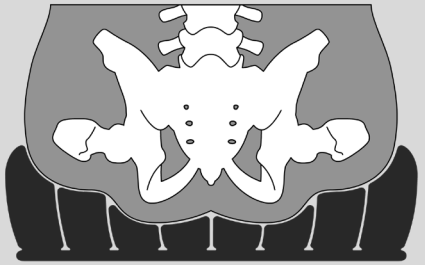
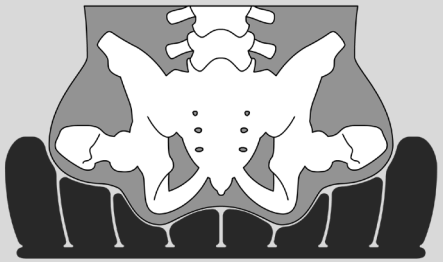
Air Fluid vs Engineered Fluid

		
 **Indenter #1 CVA**		
 **Indenter #2 SCI**		

Why are they different?

DIFFERENCE IN IMMERSION AND SUPPORT

Air Fluid vs Engineered Fluid

	Immersion is constant, Volume is variable	Immersion is variable, Volume is constant
		
 **Indenter #1 CVA**		
 **Indenter #2 SCI**		

WHAT'S HAPPENING IN THE INTERACTION?

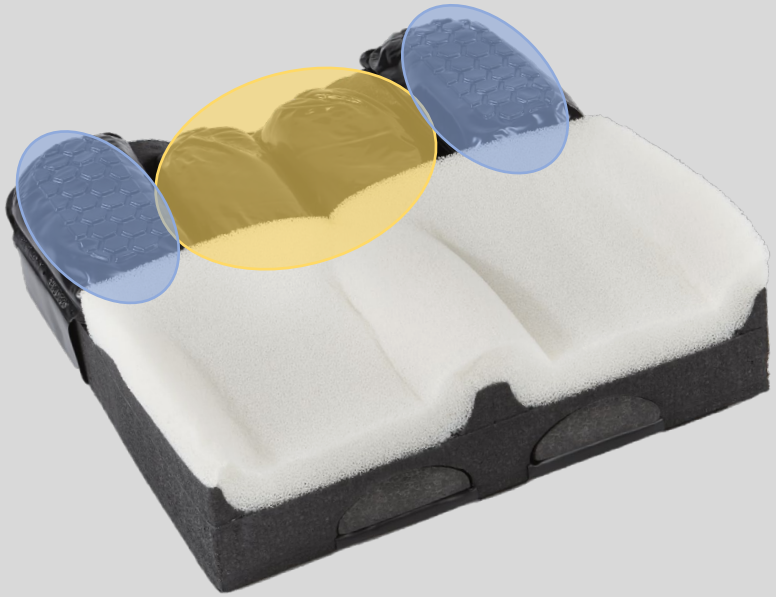
Now, let's look at engineered fluid that allows for volume adjustment

Engineered Fluid

WHAT'S HAPPENING IN THE INTERACTION?

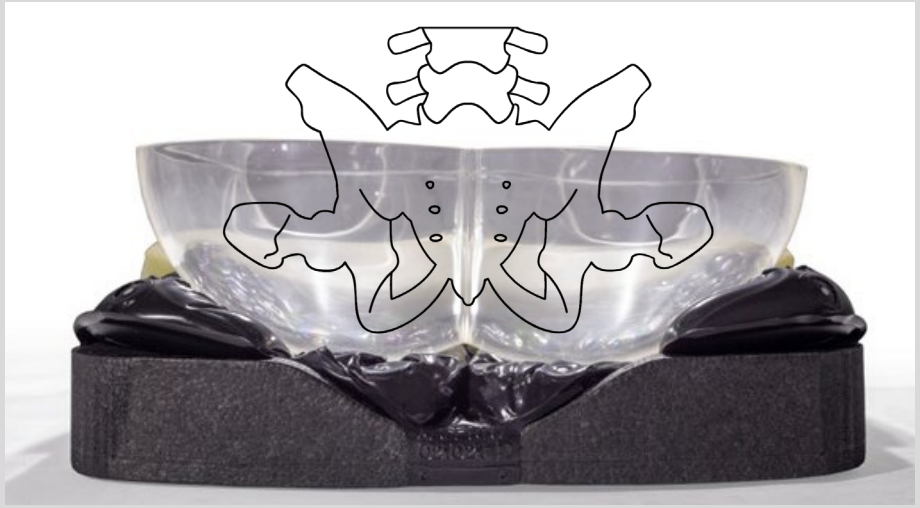
Now, let's look at engineered fluid that allows for volume adjustment

Engineered Fluid

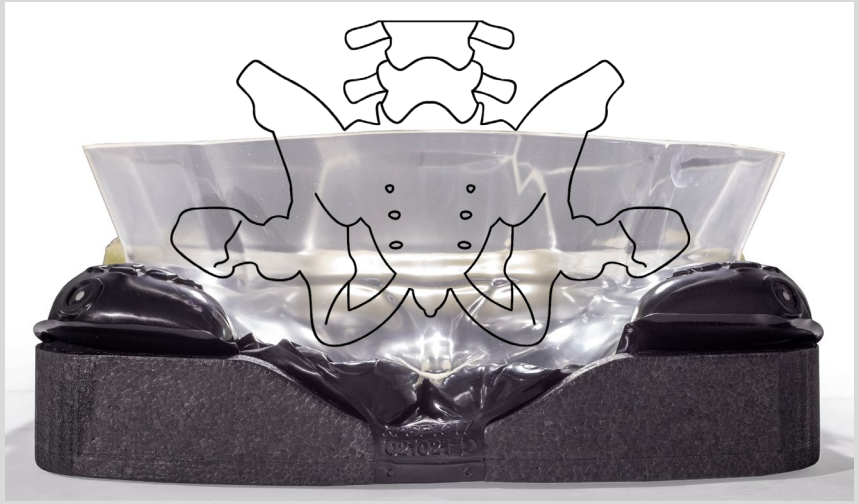


WHAT'S HAPPENING IN THE INTERACTION?

Engineered Fluid – volume adjustable



Indenter #1
CVA



Indenter #2
SCI

WHAT'S HAPPENING IN THE INTERACTION?

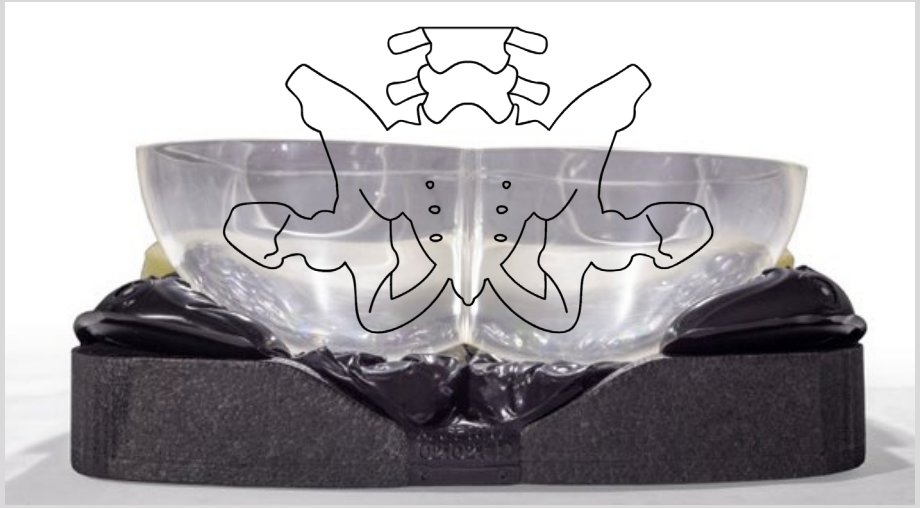
Engineered Fluid – volume adjustable

Indenter #1
CVA

Indenter #2
SCI

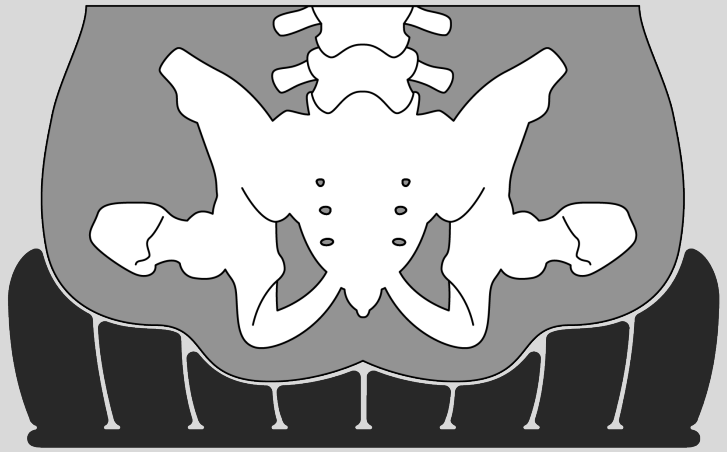
WHAT'S HAPPENING IN THE INTERACTION?

Engineered Fluid

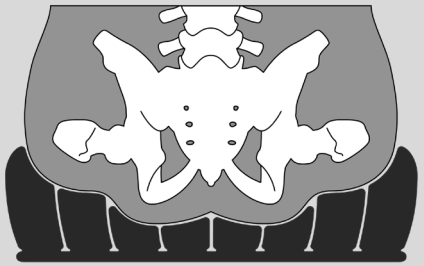
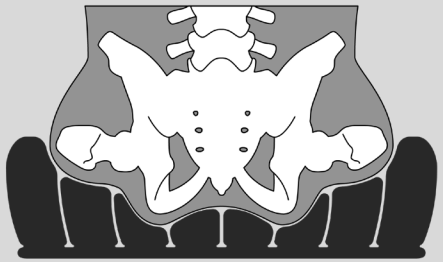


Indenter #1
CVA

Air



DIFFERENCE IN IMMERSION AND SUPPORT

Air Fluid vs Engineered Fluid	Immersion is constant, Volume is variable	Immersion is variable, Volume is constant	Immersion is variable, Volume is variable
			
 **Indenter #1 CVA**			
 **Indenter #2 SCI**			

WHAT DOES INDEPENDENT ADJUSTABILITY ALLOW?

Now, we can achieve equalized pressure where we want it (optimal)

and

We can manage where we want to allow that pressure, and where we don't want it.

Which deals with Tissue Loading. . .

TISSUE LOADING

TISSUE LOADING – DISTRIBUTION OF PRESSURE

Two common terms used for Distribution of Pressure in seating are

Equalization

TISSUE LOADING – DISTRIBUTION OF PRESSURE

Two common terms used for Distribution of Pressure in seating are

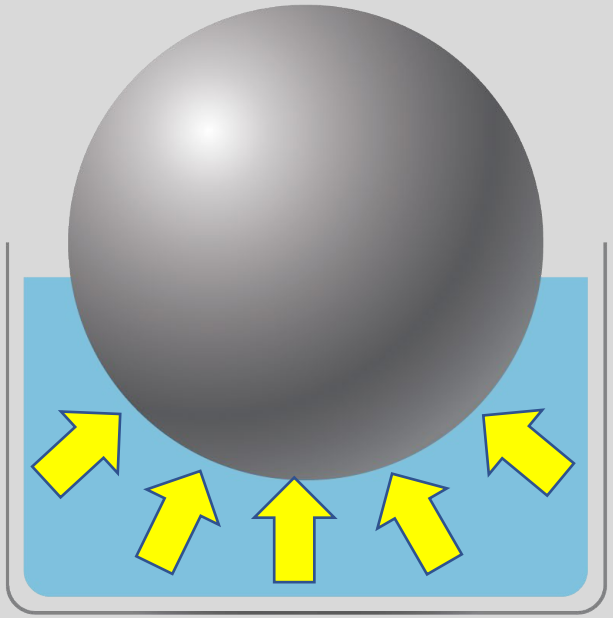
Equalization

and

Off loading-

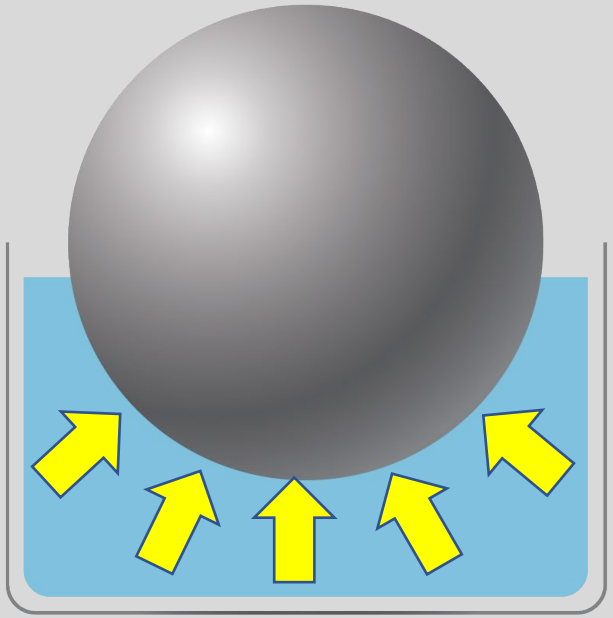
TISSUE LOADING – EQUALIZATION

Equalization results in the same pressure everywhere



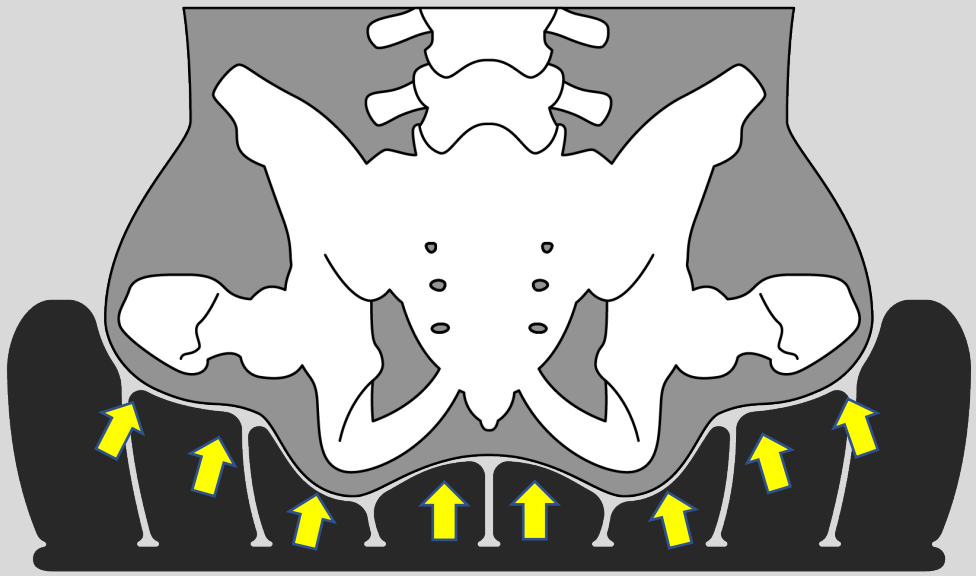
TISSUE LOADING – EQUALIZATION

Equalization results in the same pressure everywhere



TISSUE LOADING – EQUALIZATION

Equalization results in the same pressure everywhere



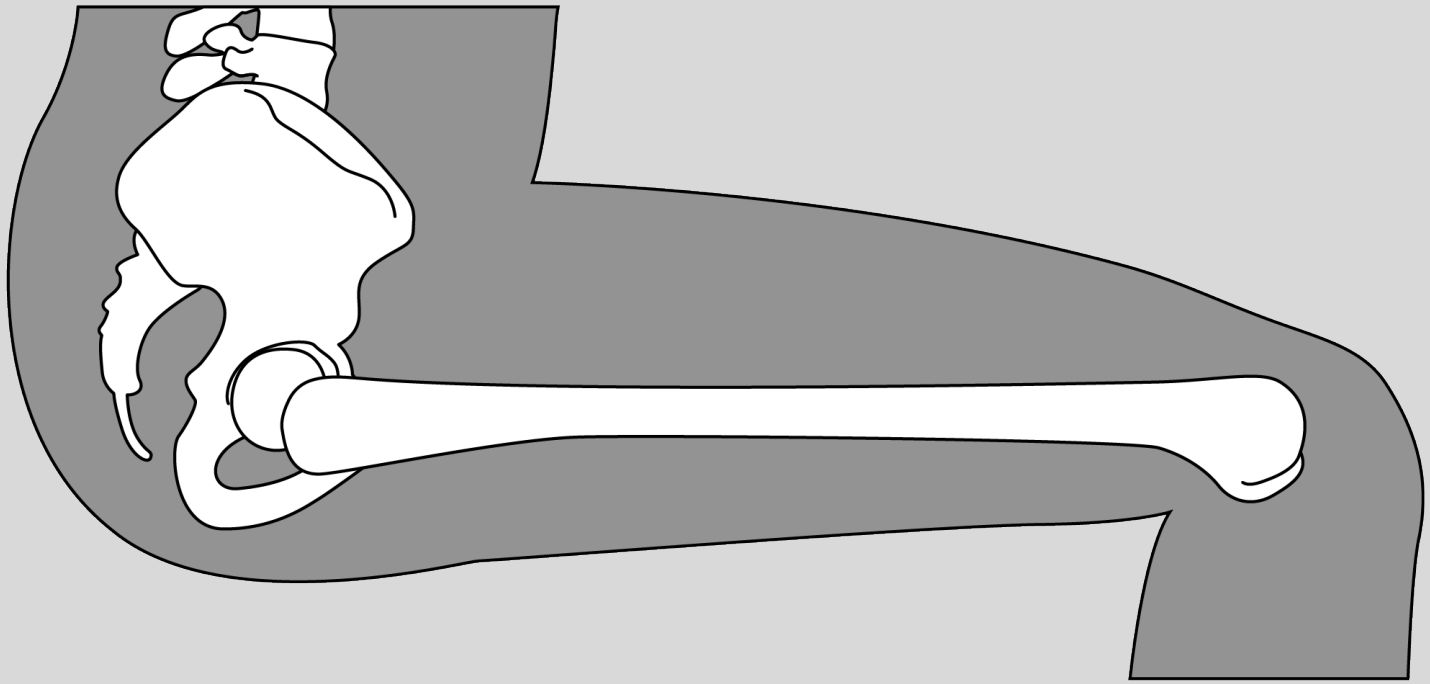
TISSUE LOADING - OFF LOADING

Off Loading – trying to take the existing load and put it somewhere else

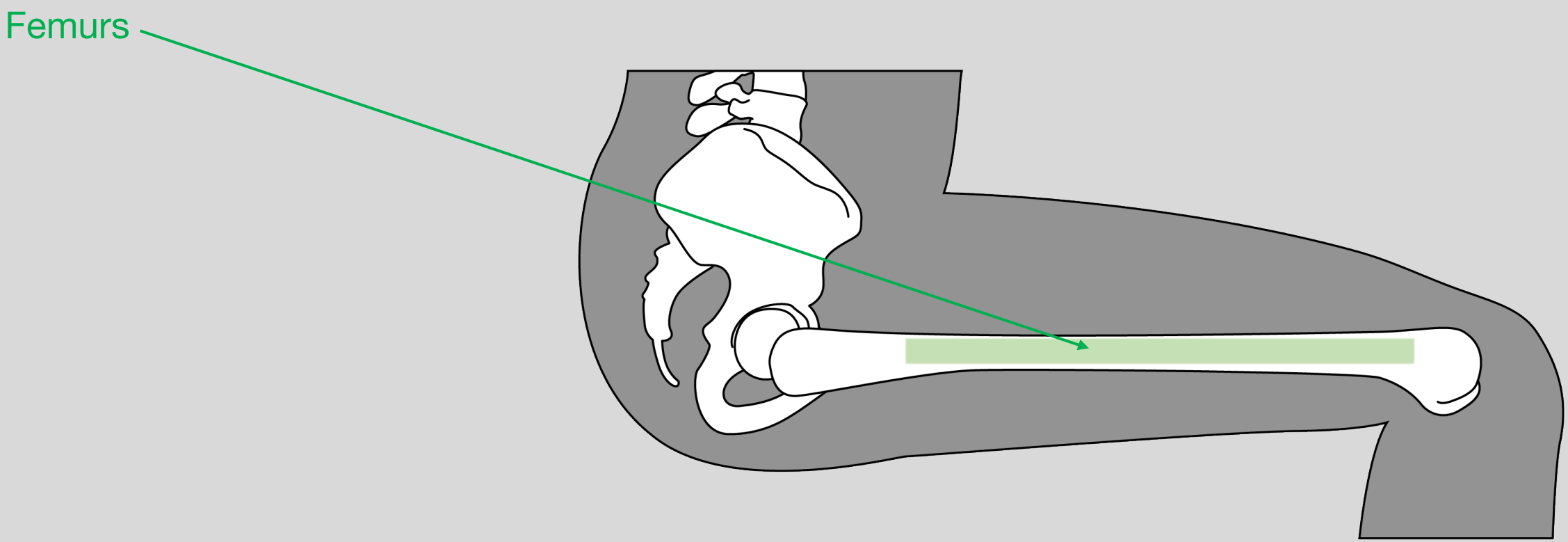
But where?

Let's look at areas that can take load. . .

Areas Available for Loading



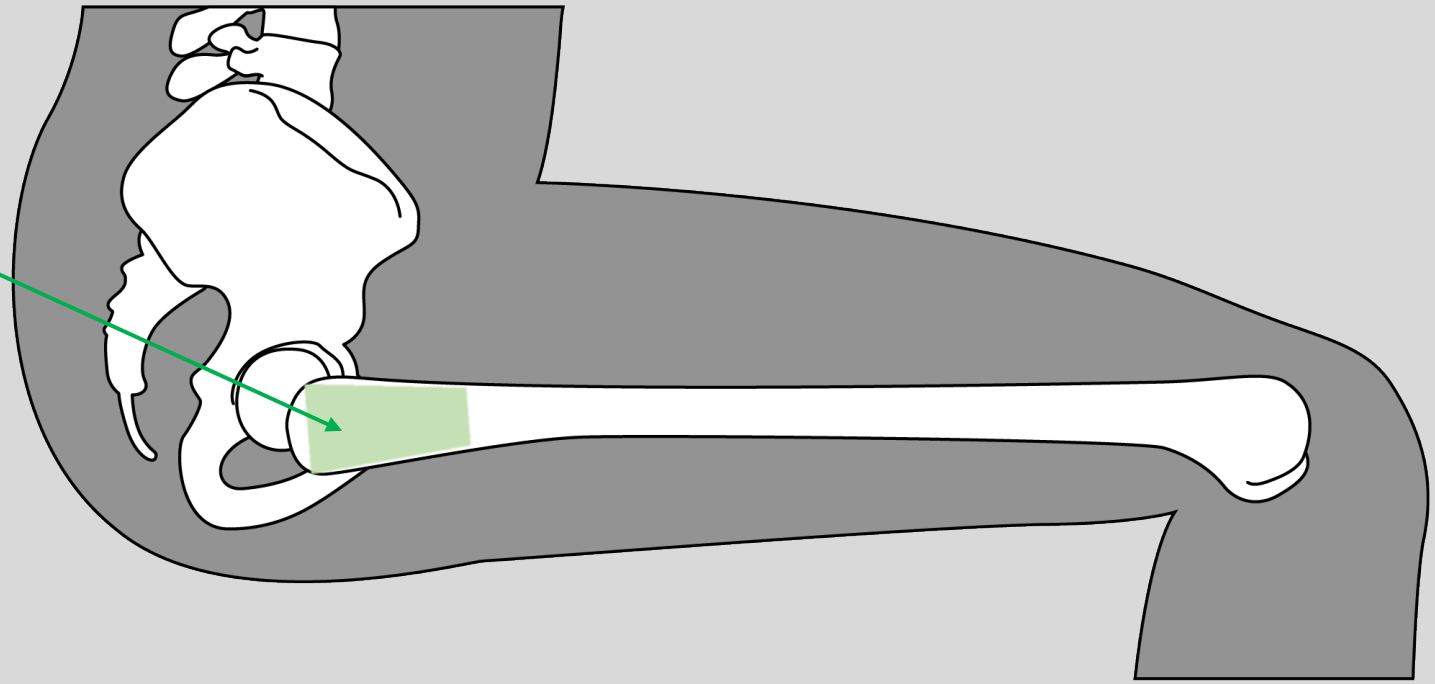
Areas Available for Loading



Areas Available for Loading

Femurs

Trochanters

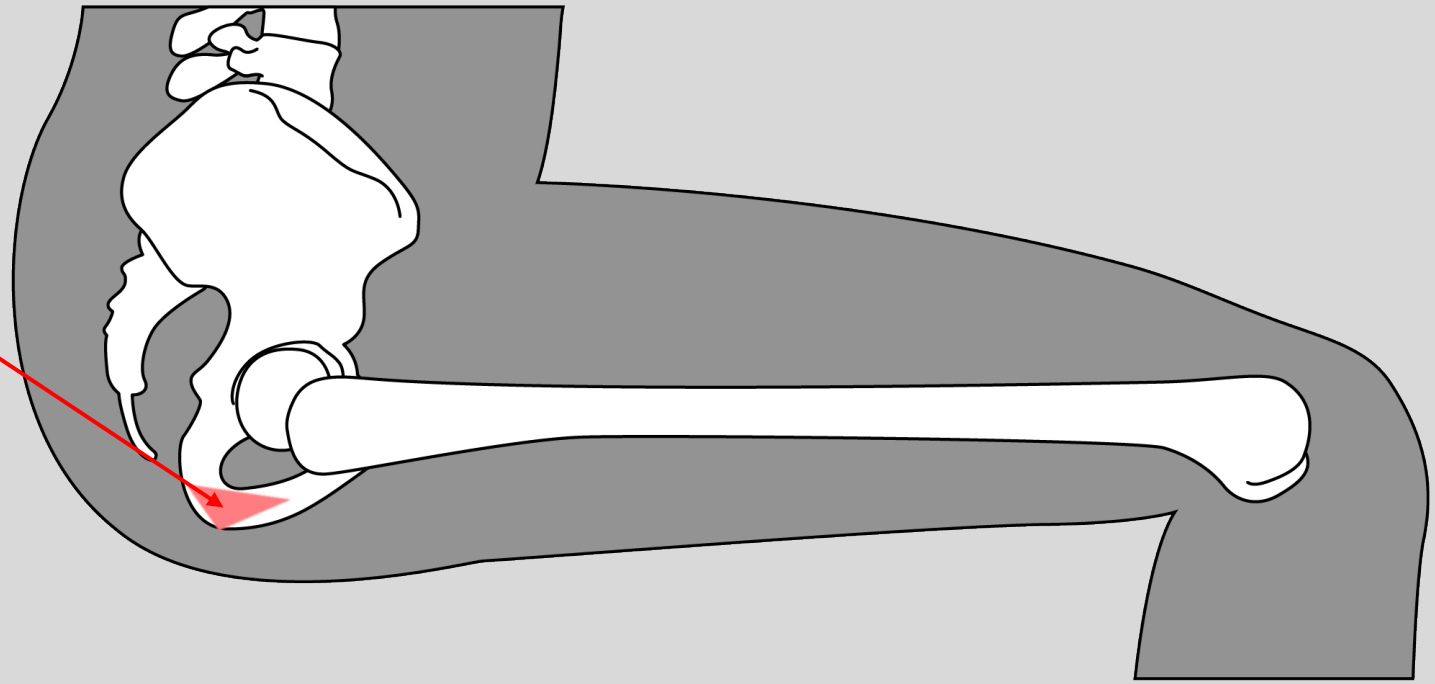


Areas Available for Loading

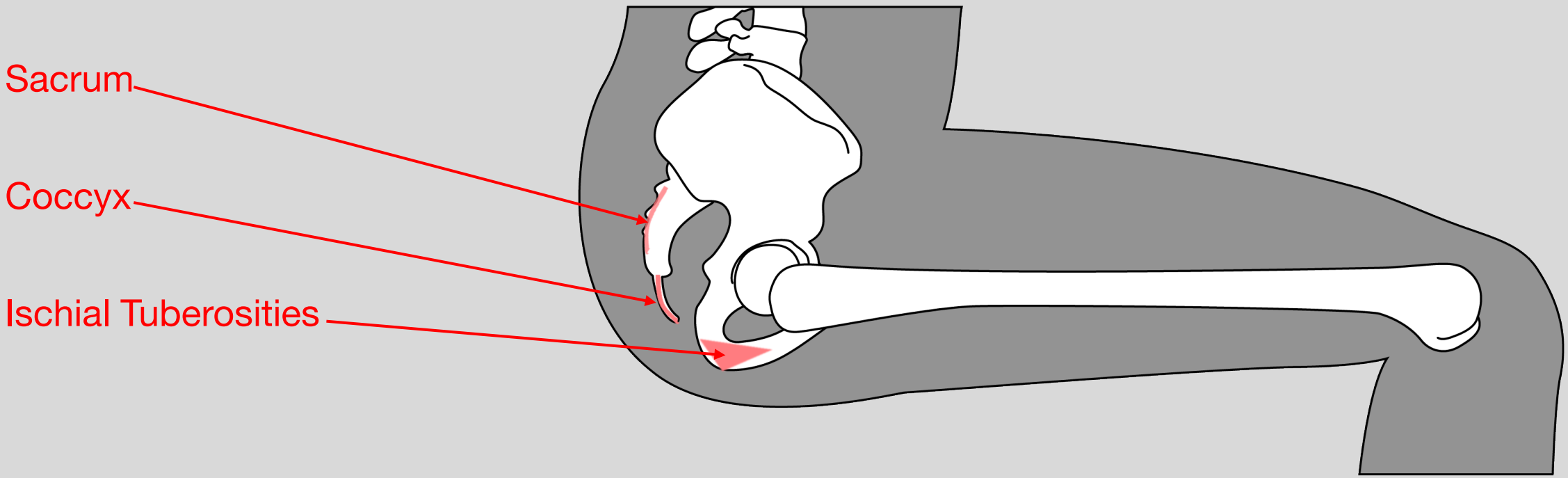
Femurs

Trochanters

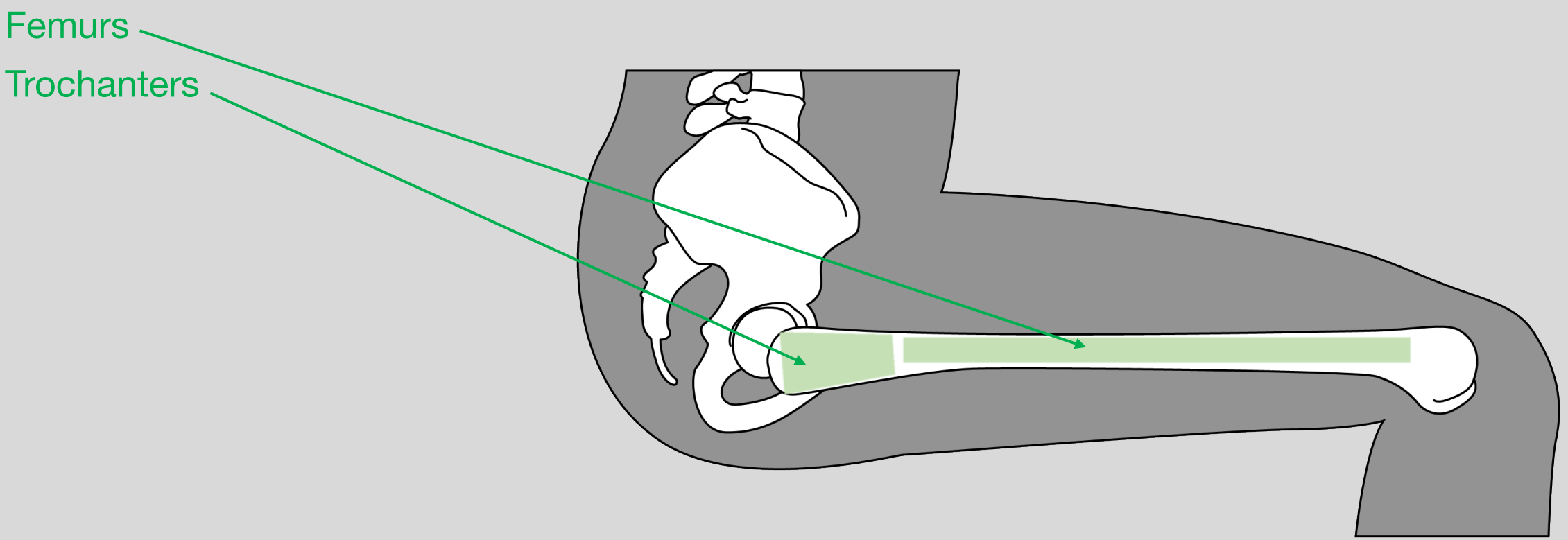
Ischial Tuberosities



Areas Commonly Considered Less Tolerant for Loading



Areas Commonly Considered Tolerant for Loading



TISSUE LOADING - OFF LOADING

Off Loading – removing some or all of the load from a particular area

Any cushion that is not homogenous in shape or material was likely designed to produce Off Loading

Classes of cushions:

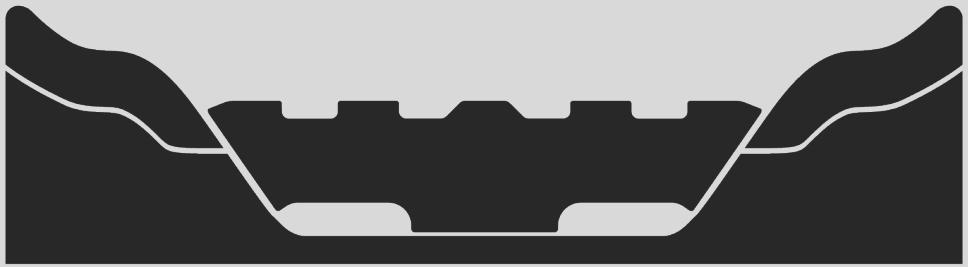
Foam

Hybrid

Fluid

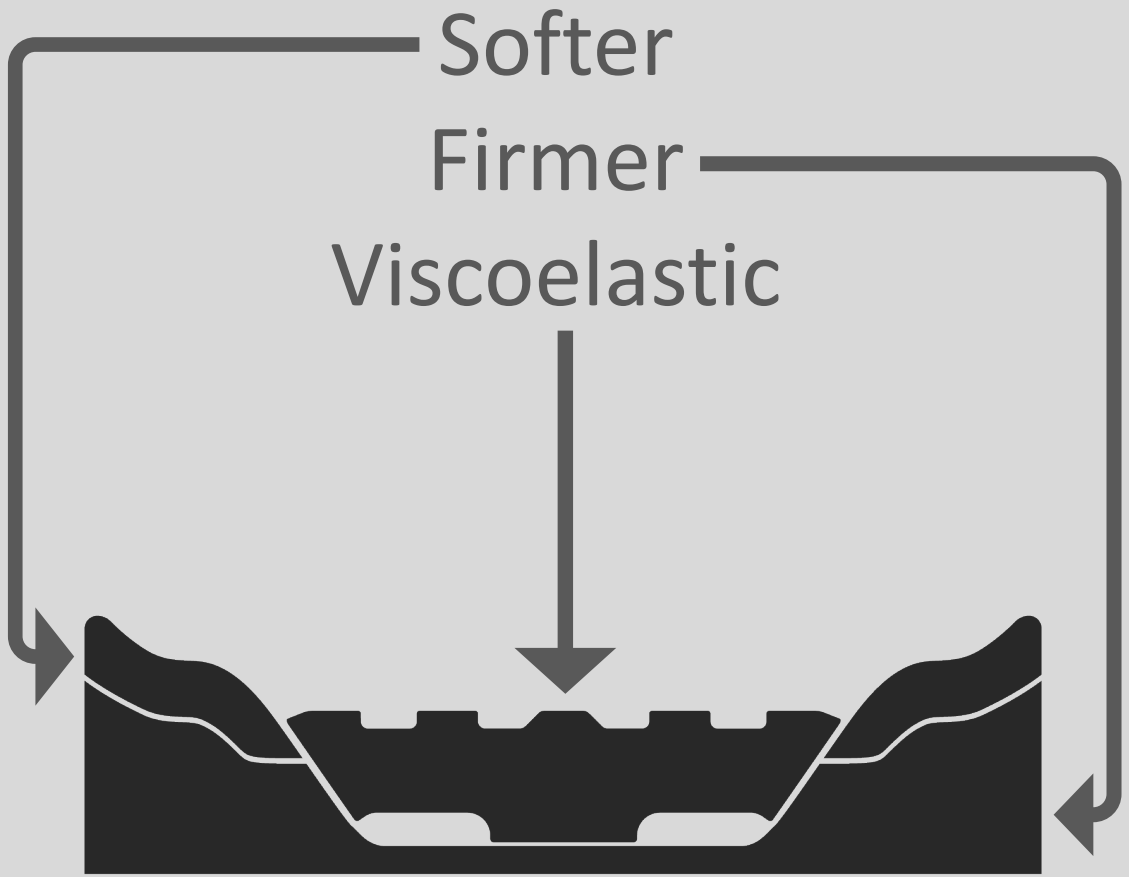
TISSUE LOADING – OFF LOADING

Foam Cushions



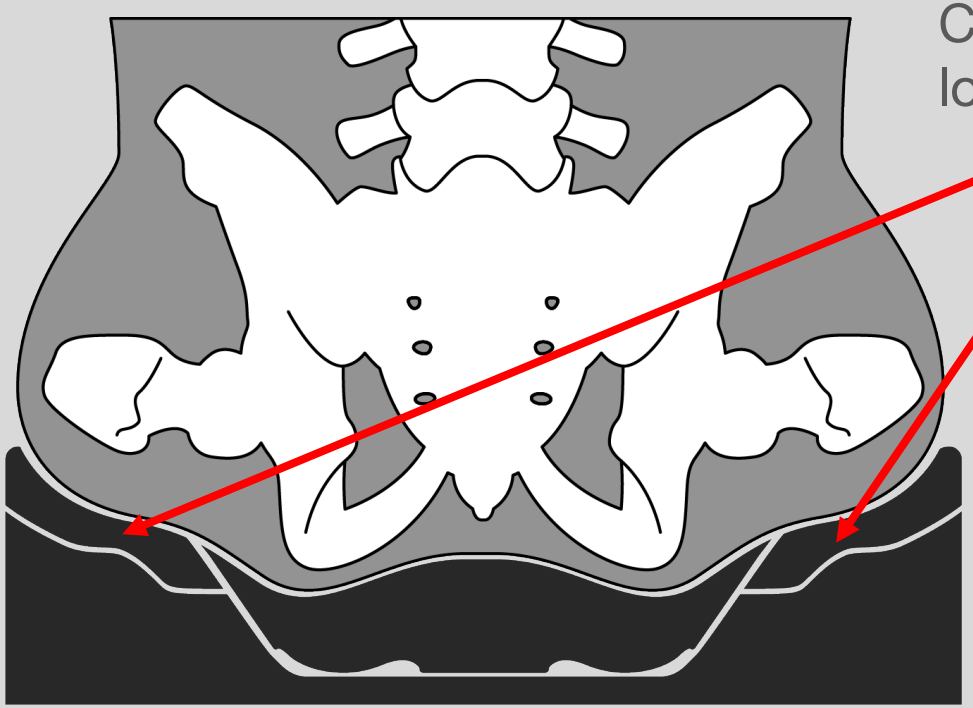
TISSUE LOADING – OFF LOADING

Foam Cushions



TISSUE LOADING – OFF LOADING

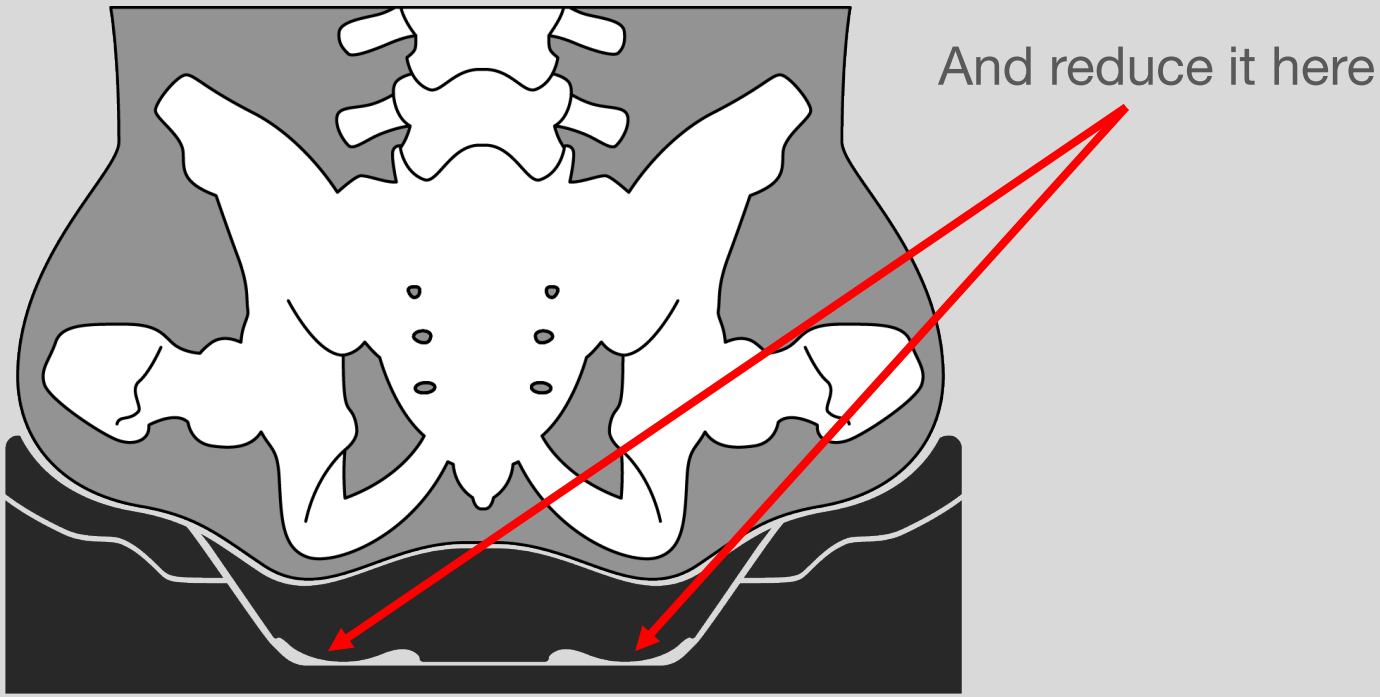
Foam Cushions



Contours and density layers to accept load here

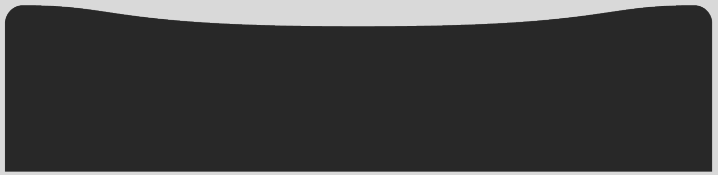
TISSUE LOADING – OFF LOADING

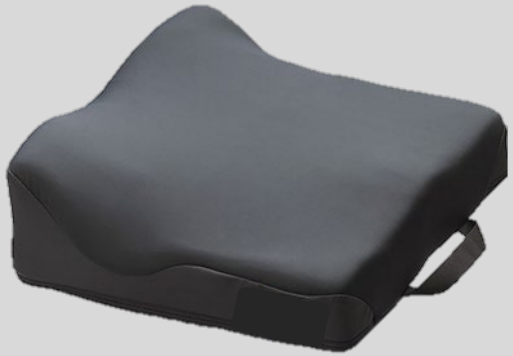
Foam Cushions

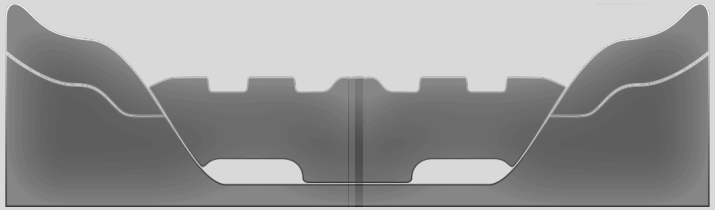


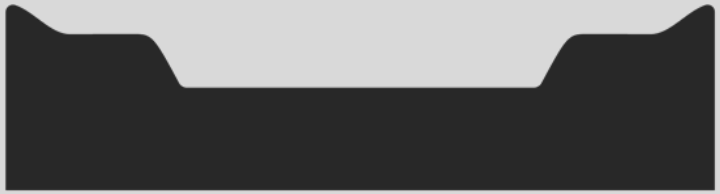
TISSUE LOADING – OFF LOADING

Foam Cushions









TISSUE LOADING – OFF LOADING

Hybrid Cushions

TISSUE LOADING – OFF LOADING

Fluid Cushions

TISSUE LOADING – EQUALIZATION

Equalized Loading, in a fluid is good. . . The pressure is as evenly spread as you can get

Off loading is good . . .

But can we do any better?

TISSUE LOADING – EQUALIZATION

Equalized Loading, in a fluid is good. . . The pressure is as evenly spread as you can get

Off loading is good . . .

But can we do any better?

What if we want to decrease pressure in high-risk areas?

TISSUE LOADING -

Equalized Loading, in a fluid is good. . . The pressure is as evenly spread as you can get

Off loading is good . . .

But can we do any better?

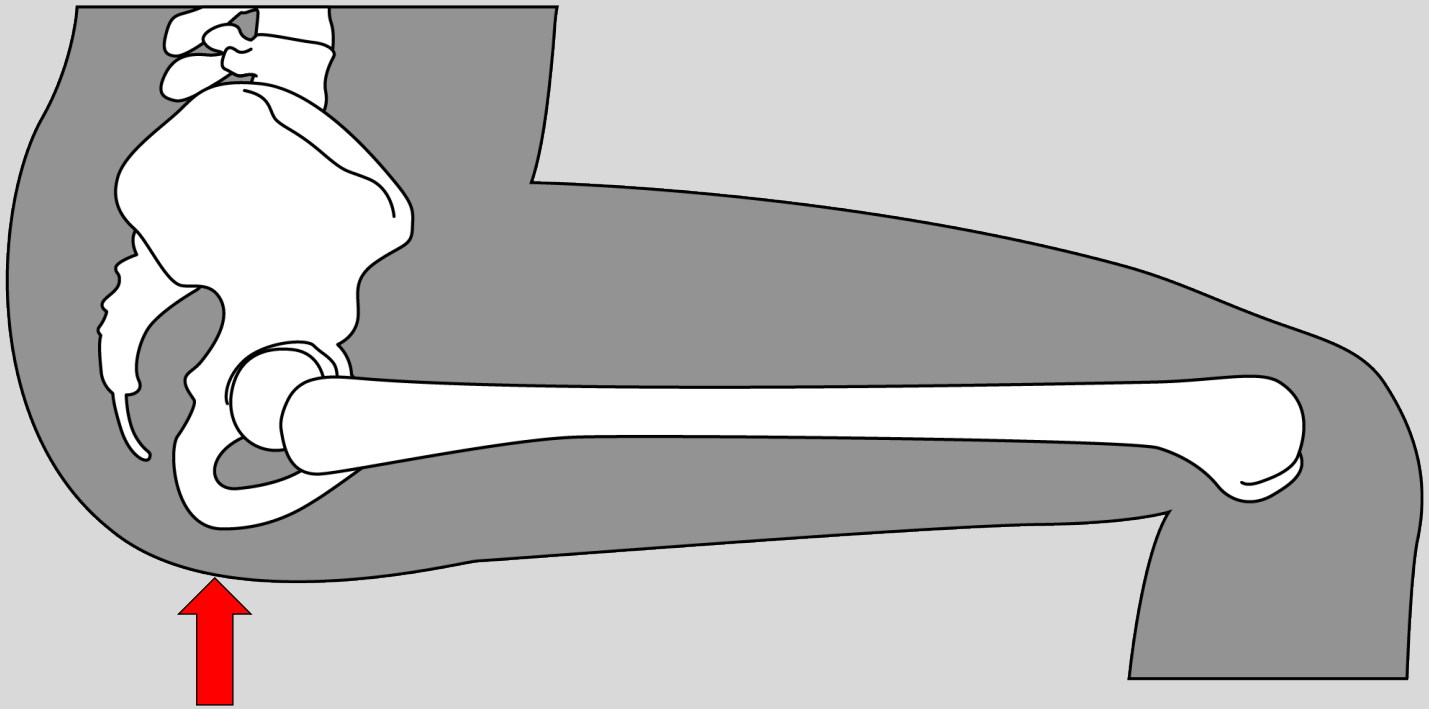
What if we want to decrease pressure in high-risk areas?

Can we direct more load to areas that are better able to tolerate a higher load, while reducing it in areas that do not tolerate the load as well?

TISSUE LOADING -

Off Loading –

We can all agree that we'd like to take pressure from under the ITs and put it . . .



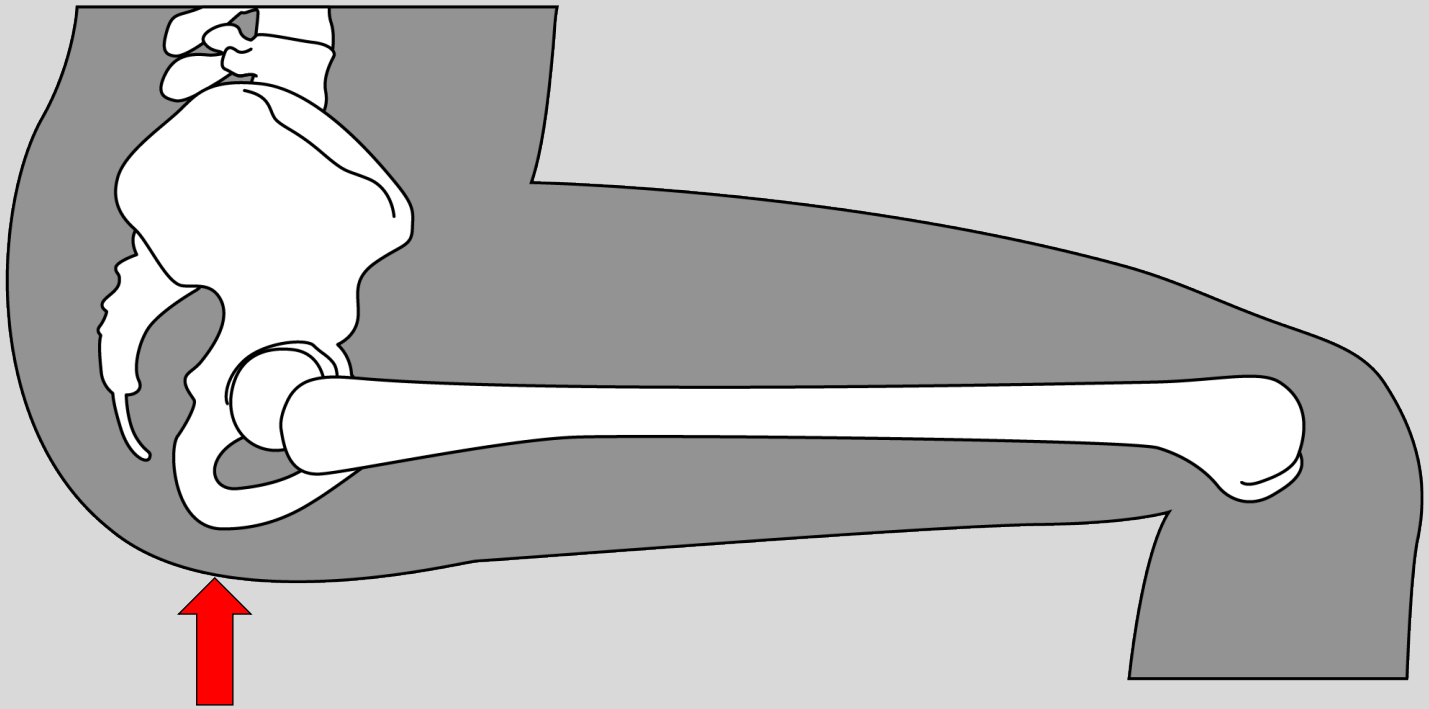
TISSUE LOADING -

Off Loading –

We can all agree that we'd like to take pressure from under the ITs

and put it . . .

well, anywhere else.



TISSUE LOADING –

~~Off Loading –~~

Directed Loading

TISSUE LOADING – DIRECTED LOADING

Directed Loading

How Do We Direct Load?

By controlling immersion.

- Immersing tolerant areas into a medium that supports the load,
- While refraining from immersing higher risk areas to a point of that same type of loading.

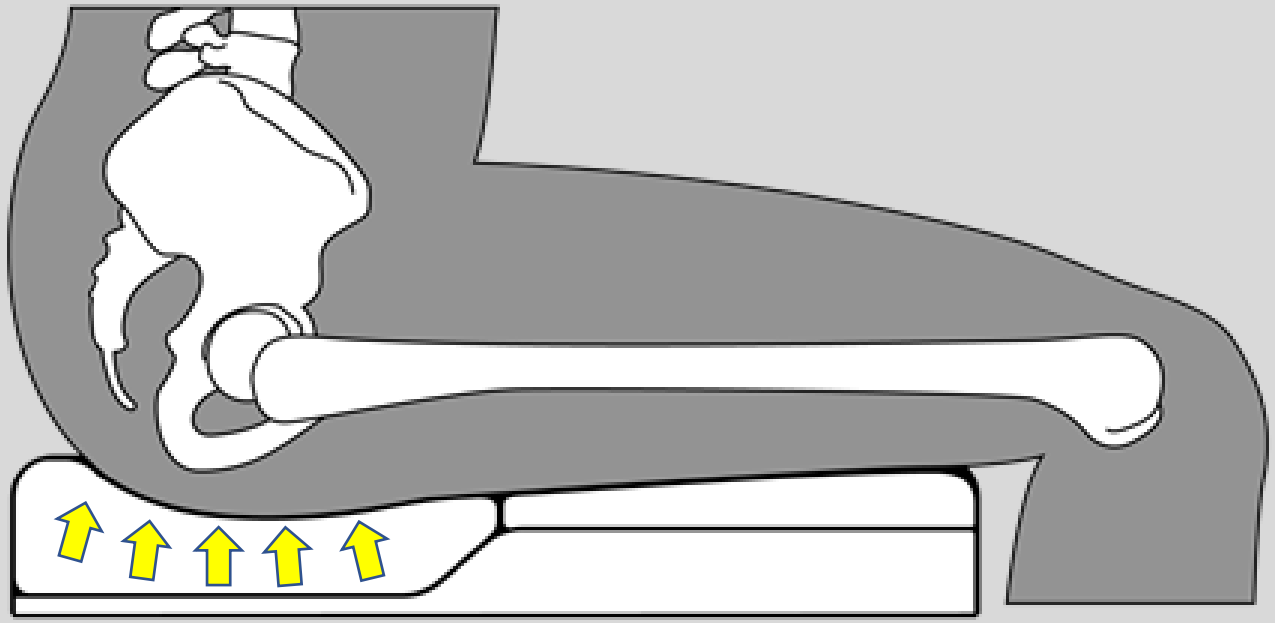
TISSUE LOADING – DIRECTED LOADING

Directed Loading

How Do different cushions allow you to direct load?

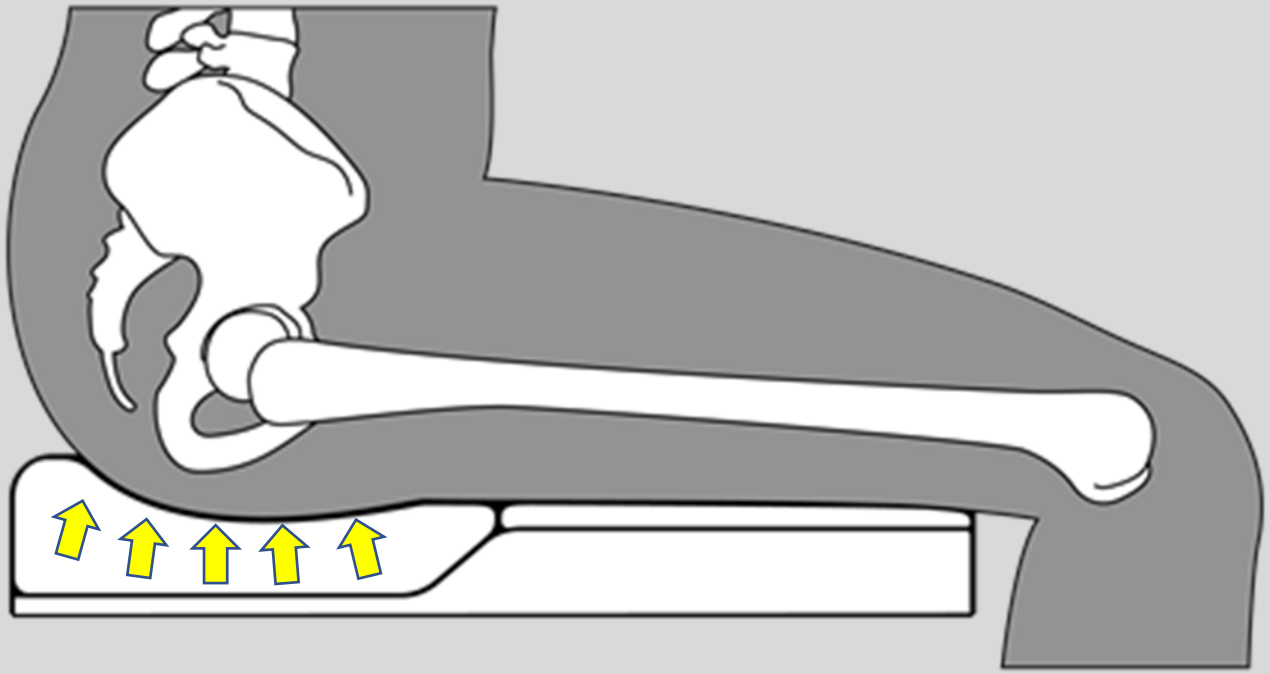
TISSUE LOADING – DIRECTED LOADING

One method to direct load. . .



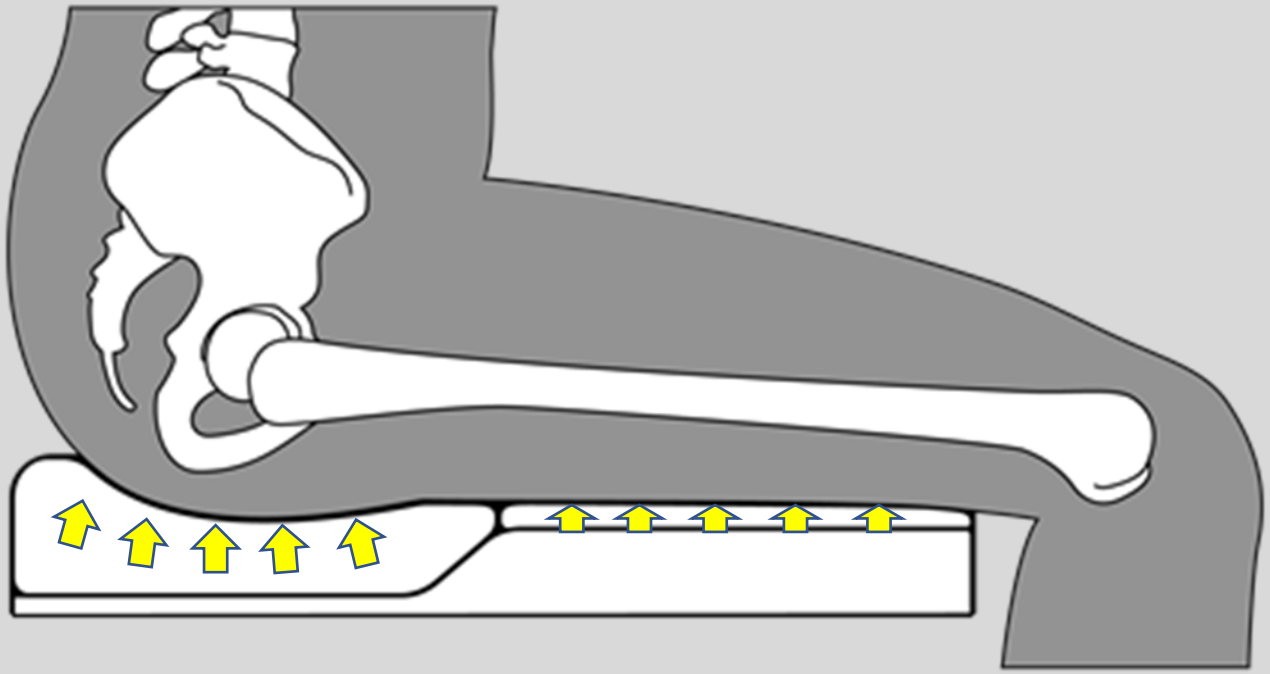
TISSUE LOADING – DIRECTED LOADING

Shift more load to the thigh



TISSUE LOADING – DIRECTED LOADING

Shift more load to the thigh



TISSUE LOADING – DIRECTED LOADING

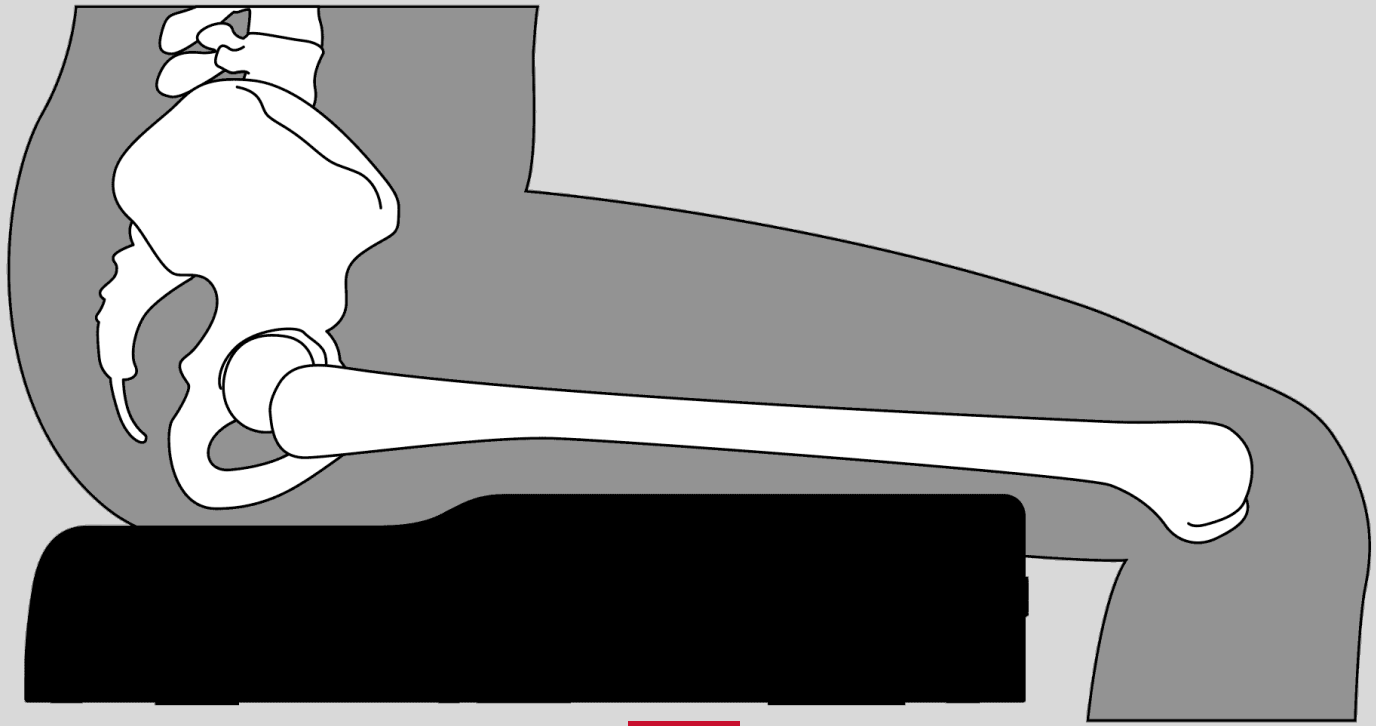
A different method to direct load – adjusting fluid volume

By decreasing fluid volume under the ITs we can allow immersion to the point that the Trochanters become loaded

TISSUE LOADING – DIRECTED LOADING

A different method to direct load – adjusting fluid volume

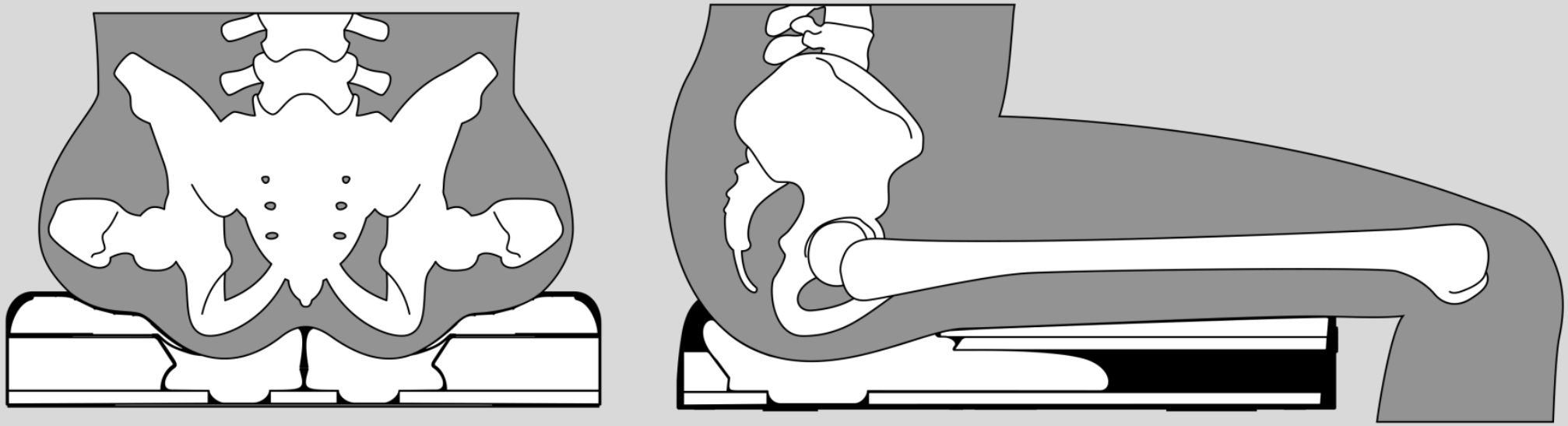
By decreasing fluid volume under the ITs we can allow immersion to the point that the Trochanters become loaded



TISSUE LOADING – DIRECTED LOADING

A different method to direct load – adjusting fluid volume

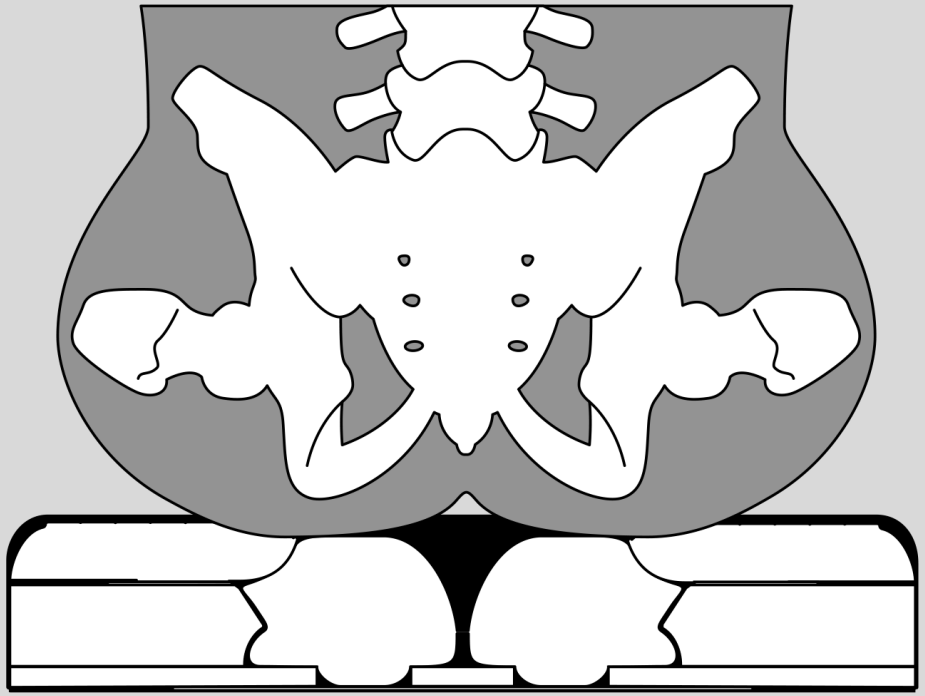
By decreasing fluid volume under the ITs we can allow immersion to the point that the Trochanters become loaded



TISSUE LOADING – DIRECTED LOADING

A different method to direct load – adjusting fluid volume

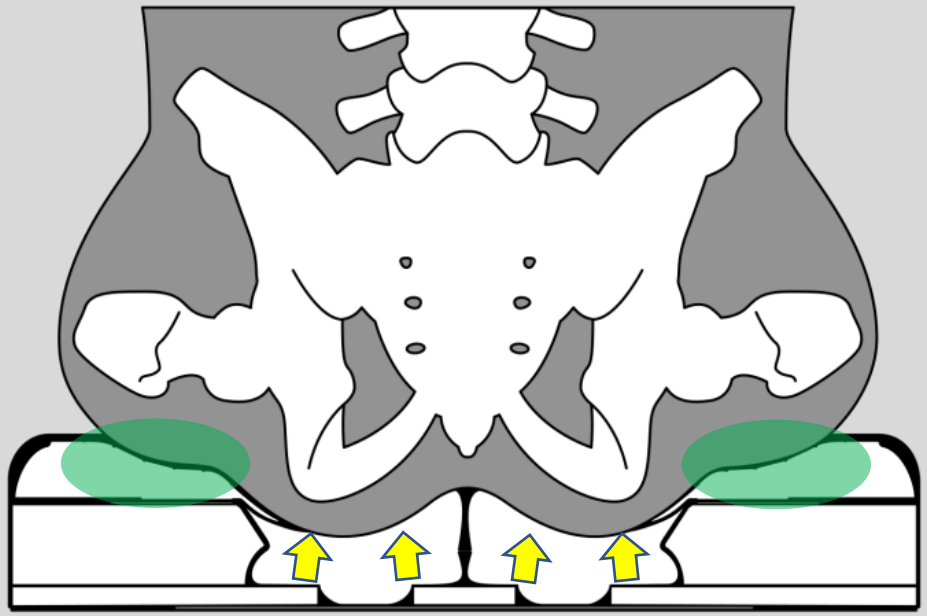
By decreasing fluid volume under the ITs we can allow immersion to the point that the Trochanters become loaded



TISSUE LOADING – DIRECTED LOADING

A different method to direct load – adjusting fluid volume

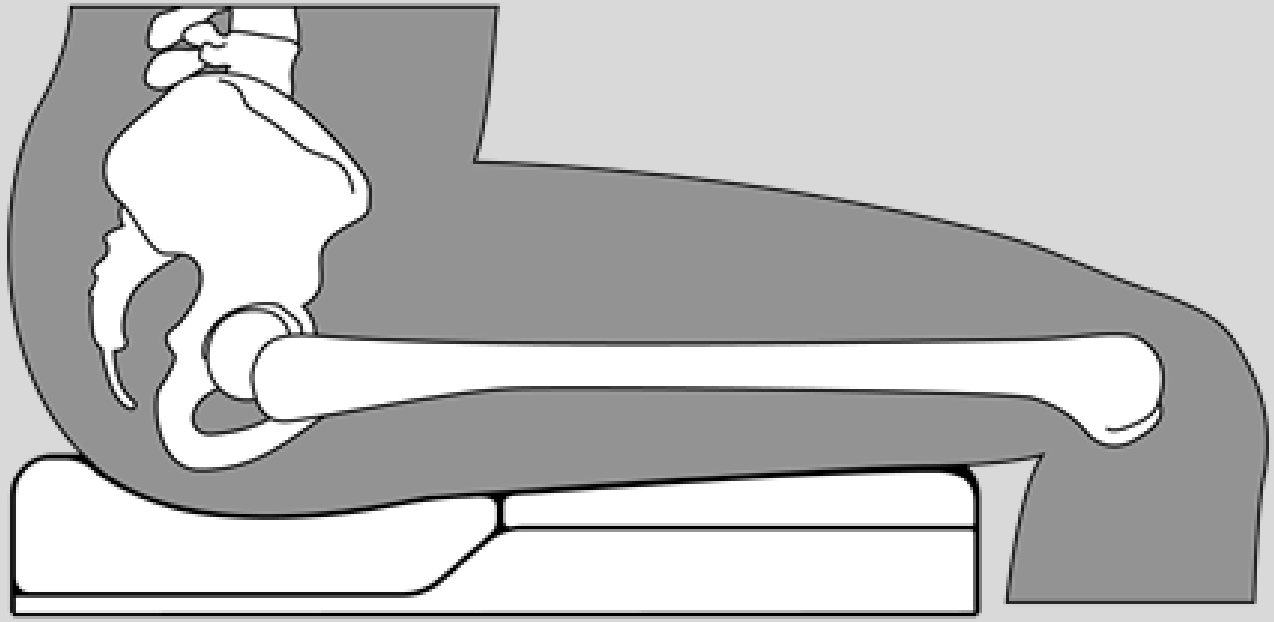
By decreasing fluid volume under the ITs we can allow immersion to the point that the Trochanters become loaded



ADJUSTABLE CUSHIONS, ARE THEY BETTER?

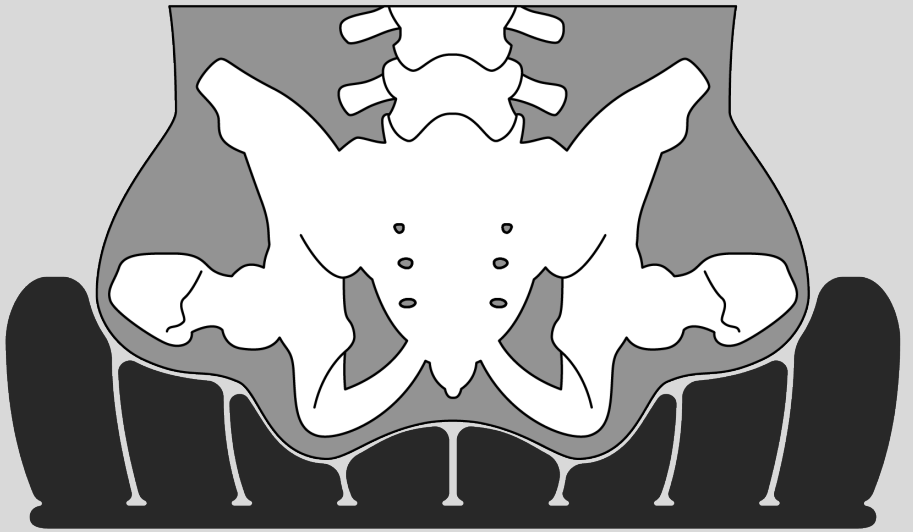
ADJUSTABLE CUSHIONS, ARE THEY BETTER?

A cushion with a displaceable material, a fluid, will envelop better than one with a compressible material



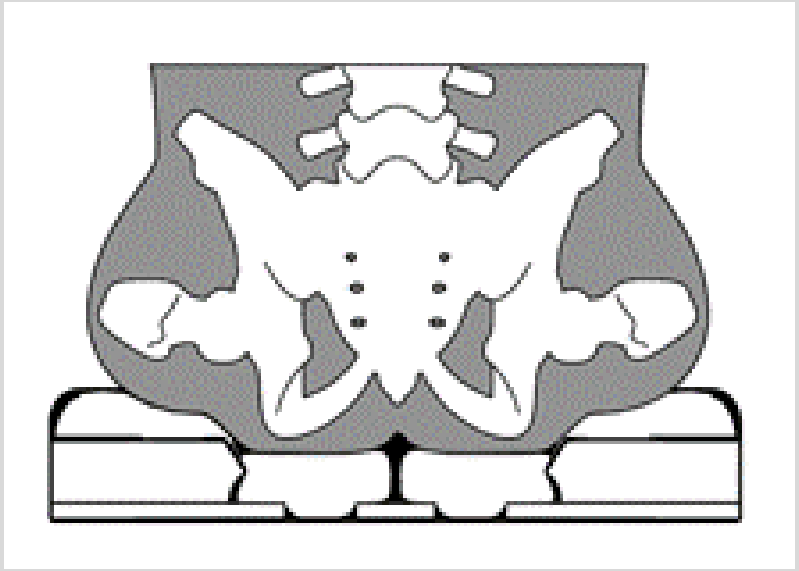
ADJUSTABLE CUSHIONS, ARE THEY BETTER?

A cushion that allows for the volume of that fluid to be adjusted will allow for immersion leading to support of the trochanters and optimum pressure distribution (hydrostatic loading)



ADJUSTABLE CUSHIONS, ARE THEY BETTER?

A cushion that has separate fluid chambers **and** adjustable volume will allow for optimal hydrostatic loading in areas that can tolerate the load, while also allowing for directing load from areas less tolerant of the load to areas that are more tolerant (while still hydrostatically loaded in all fluid areas)



Engineered fluid, more stable

Air fluid, more immediately responsive to minute weight shifts

SESSION OBJECTIVES - REVIEW

- Explain the various methods of pressure redistribution in wheelchair cushions and how they could affect pressure values at specific points.
- Explain how viscosity in wheelchair cushions may affect stability.
- Explain the importance of being able to adjust the fluid volume of a wheelchair cushion ‘in the field’ during an initial fitting or a follow-up with a user.

ADJUSTABLE CUSHIONS, ARE THEY BETTER?

?

End

Thank You