

# Le mouvement: ange ou démon de l'arthrose de genou?

*Dr ès sc. Julien Favre*



# Survey

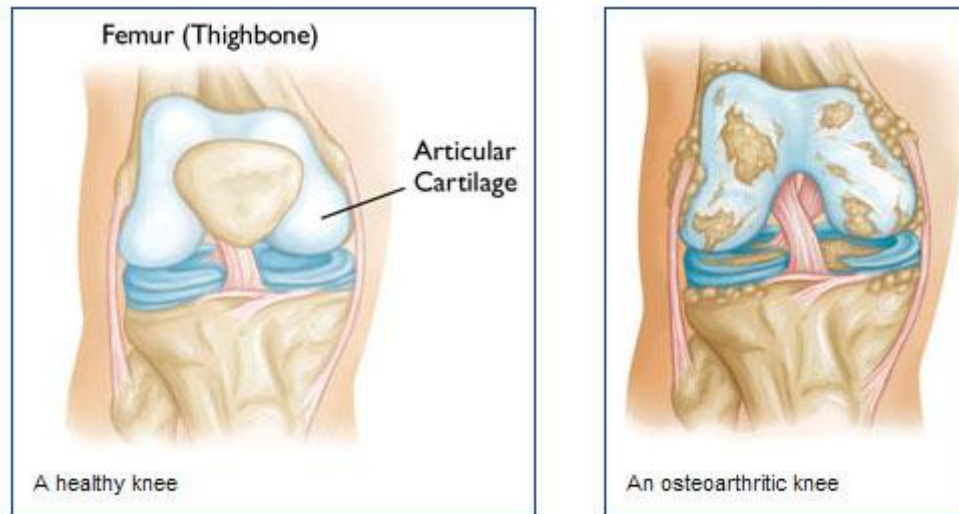
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Disclaimer: This presentation contains ongoing research and further work is necessary before results can be transferred to clinical practice.

# Knee osteoarthritis (OA)

- One of the 10 leading disease burdens in high-income countries (20-40% of individuals over 65 years of age)
- Health costs at 1-2.5% of the GNP
- Limited understanding of the disease - no cure



*Courtesy of UCSF*

# Occupation - physical activity

## Cross-sectional studies in mixed populations

- ☹ Increased risks in individuals with repetitive knee bending activities (Felson 1991, Coggon 2000)
- ☹ Increased risks in elite sportsmen (Kujala 1995, Spector 1996)

## Longitudinal studies on non-OA subjects

- 😊 No association with OA incidence (Manninen 2001, Felson 2013, Barbour 2014)
- ☹ Association with OA incidence

## Longitudinal studies

- 😊 Protective against progression
- 😊 No differences in new onset
- ☹ Increased incidence of OA in individuals with baseline abnormalities (Doré 2013)  
→ especially in knee with baseline abnormalities (Doré 2013)

## Cross-sectional studies on non-OA / asymptomatic subjects

- 😊 No association with cartilage defects and association with cartilage volume (Hanna 2007, Racunica 2007)
- ☹ Association with cartilage lesions (Stehling 2010)
- 😊 No association with cartilage metrics (Kretzschmar 2015)
- ☹ Association with meniscal lesions and BML (Kretzschmar 2015)

These studies analyzed **how much**,  
but no **how** did the knee function

Unclear  
if/how focal  
damages  
can lead  
to OA

# Which aspect of the knee function should be considered?



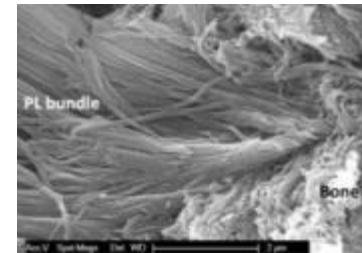
Courtesy of Shue Li, Newcastle University



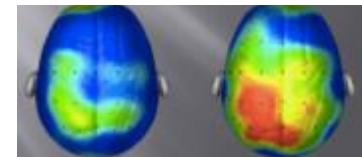
Courtesy of ACR



ablazetotalsolutions.com



Courtesy of L. Zhao, U Auckland

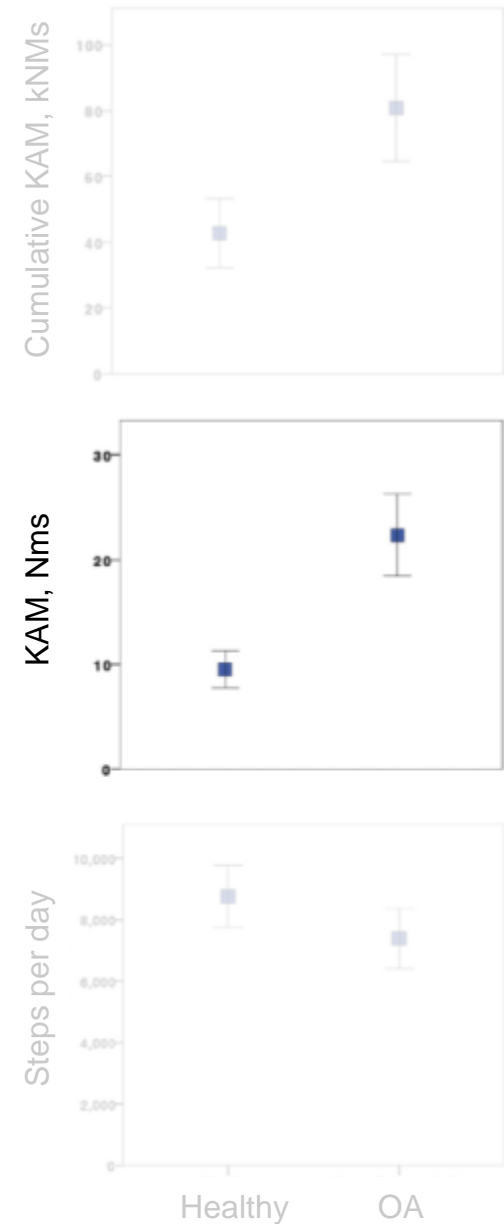
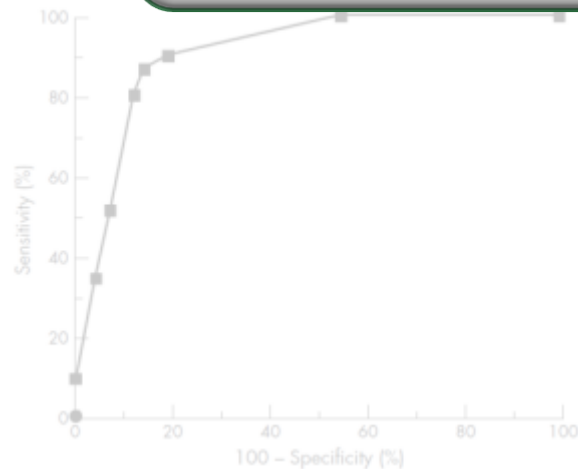


Courtesy of C. Hillman, UIC

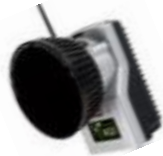
# Knee loading during walking

- Relationship between **knee adduction moment (KAM)** and high tibial osteotomy (Prodromos 1985)
- Higher risk for radiolucency in patients with high KAM

Supports the idea that  
**knee function is critical**



# Knee ambulatory function measurement



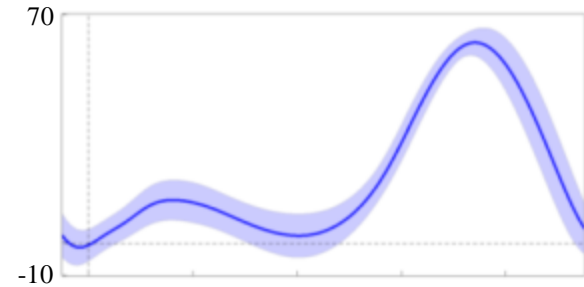
Point Cluster Technique

(Andriacchi 1998, Alexander 2001, Dyrby 2004)

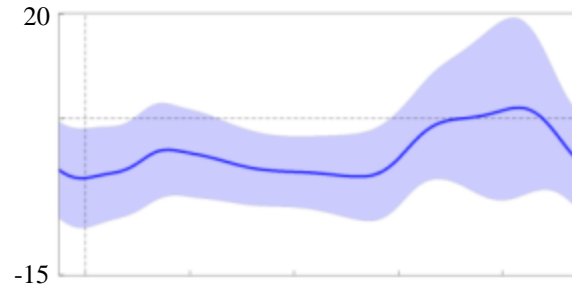


# Knee ambulatory function

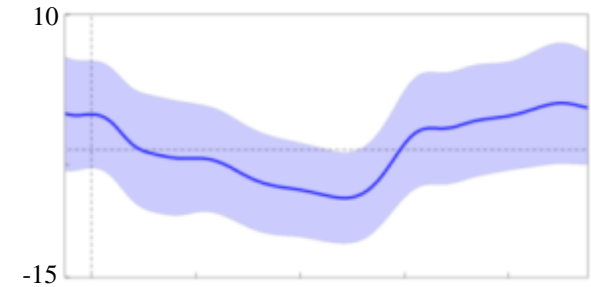
Flexion angle,  $^{\circ}$



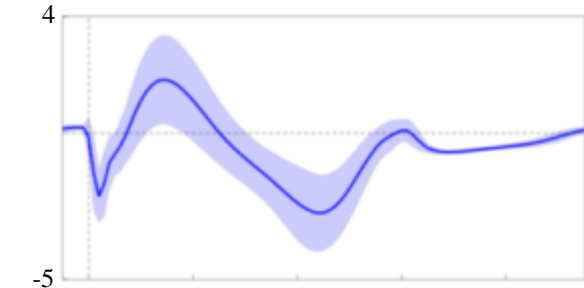
Adduction angle,  $^{\circ}$



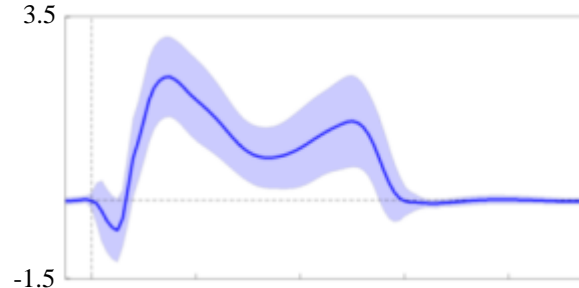
Ext. rotation angle,  $^{\circ}$



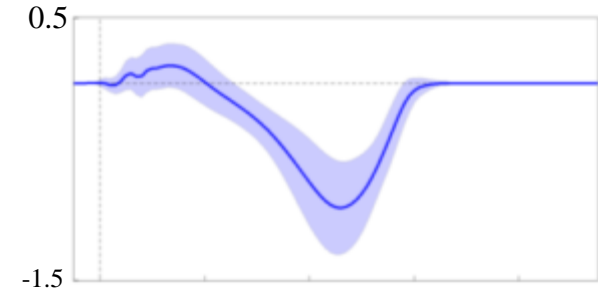
Flexion moment, %BW\*Ht



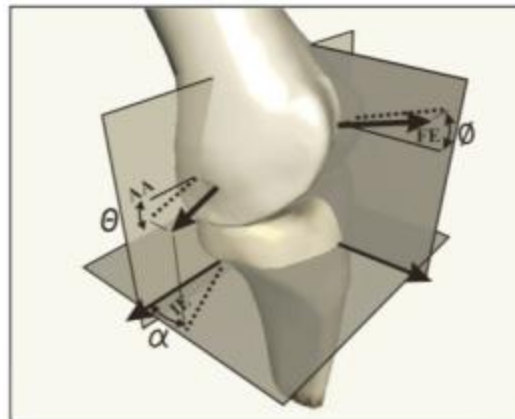
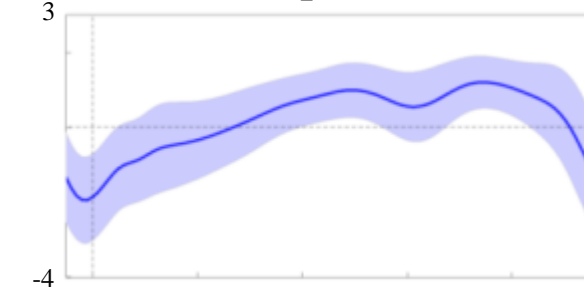
Adduction moment, %BW\*Ht



Ext. rotation moment, %BW\*Ht



Anterior displacement, cm



(Grood 1983, Andriacchi 2004)

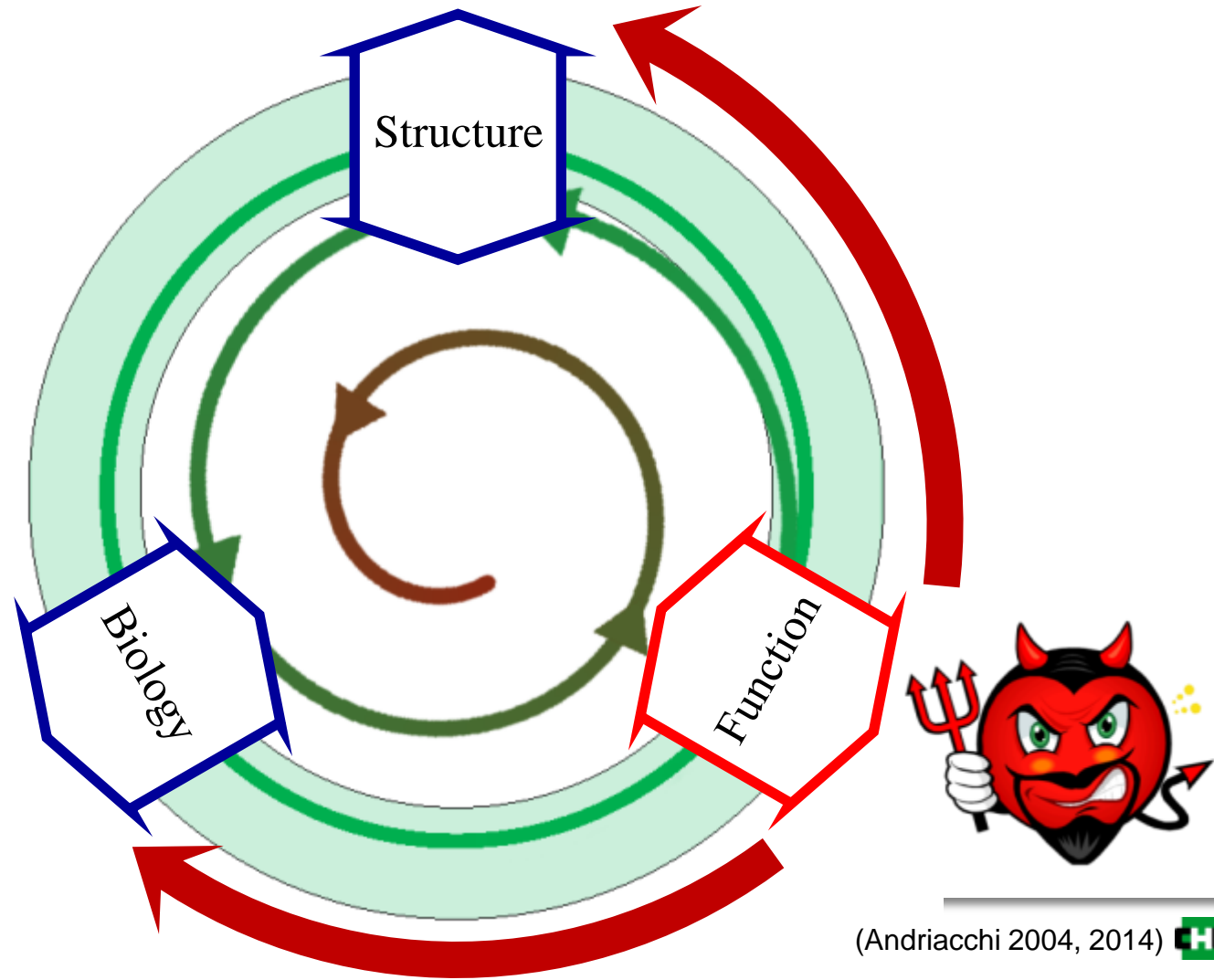


# So, ambulatory knee function, devil or angel?

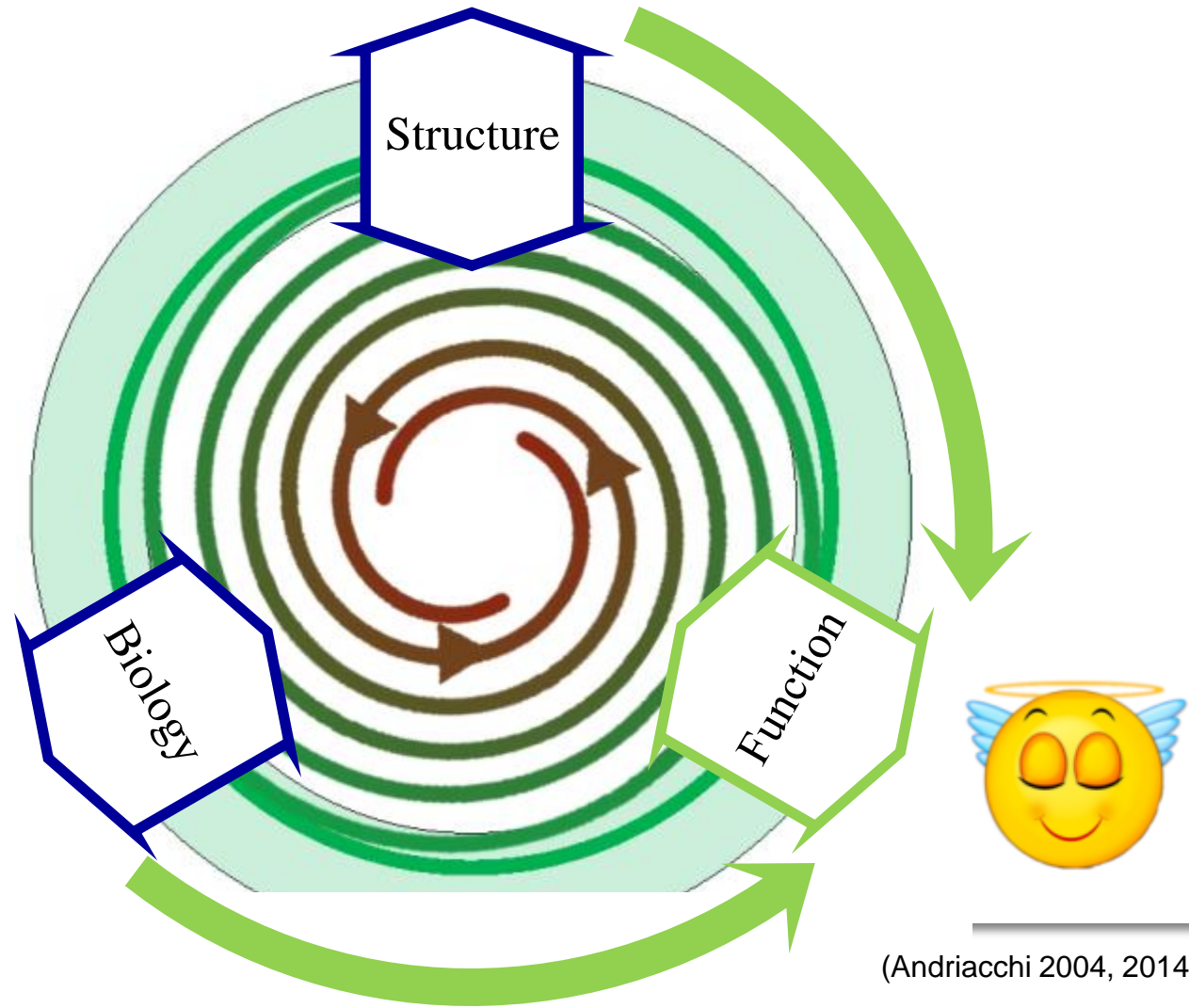


popsugar.com

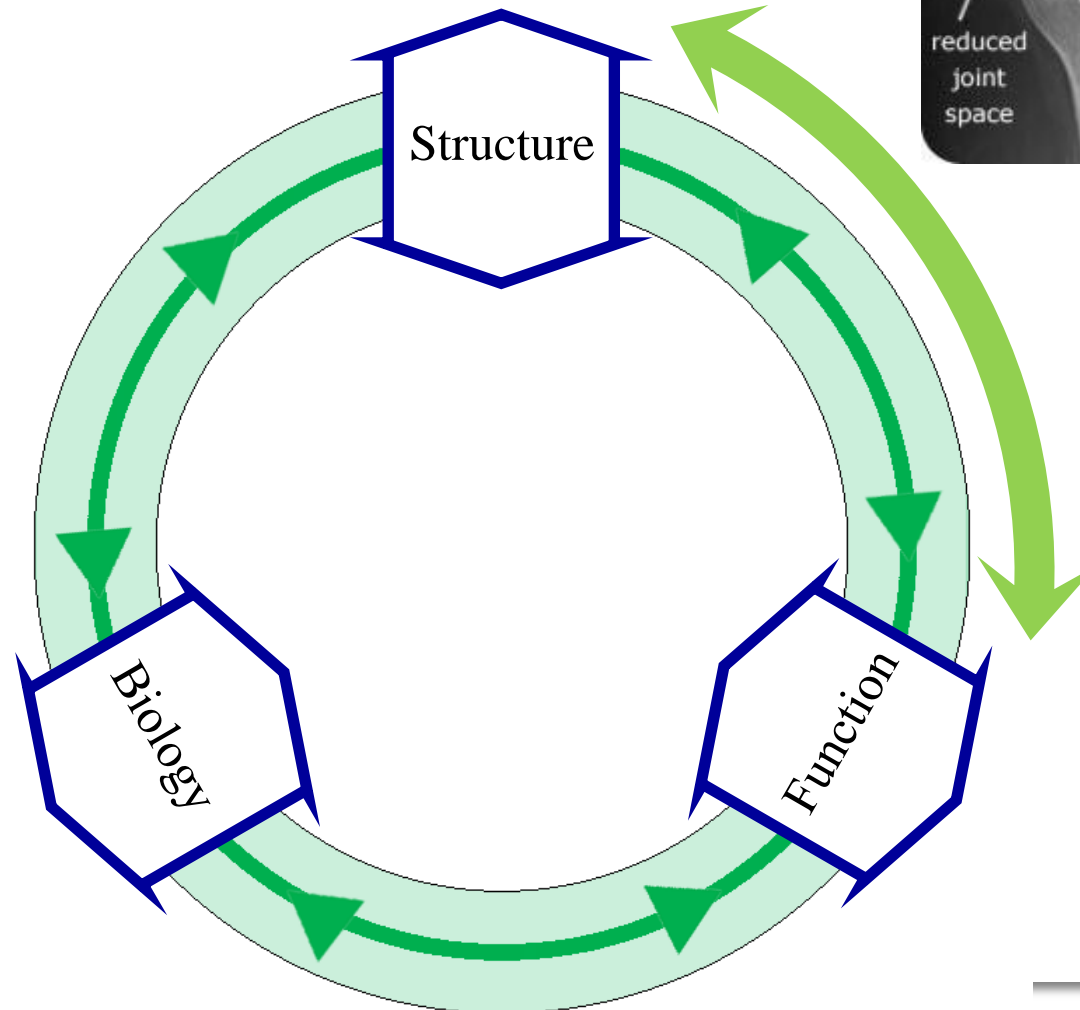
# Overall OA framework



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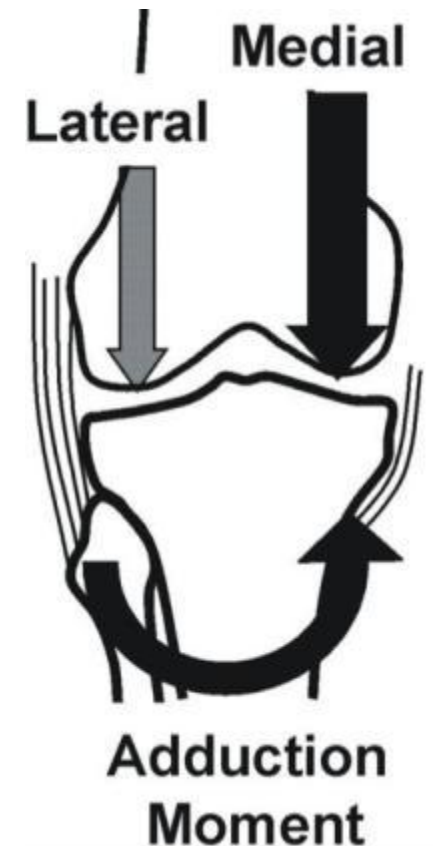
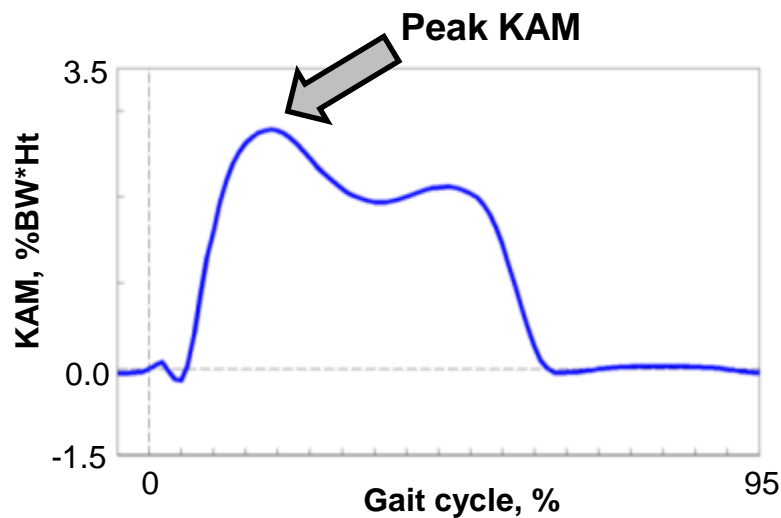


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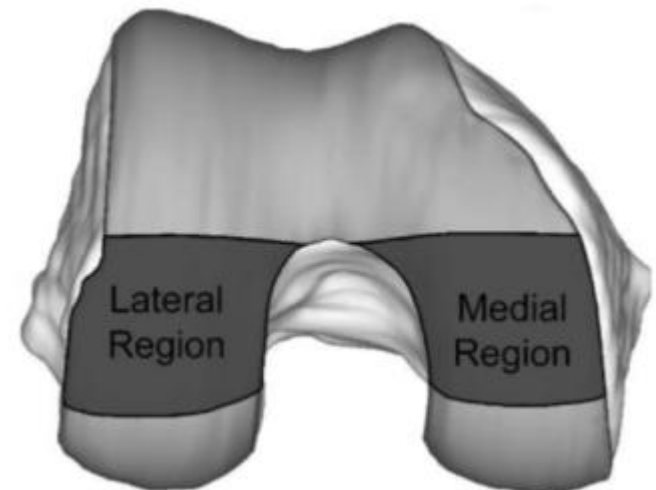
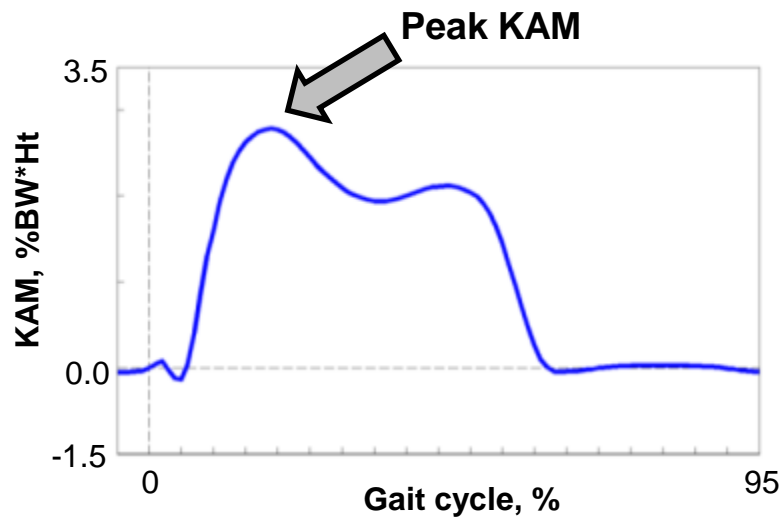
# KAM and M/L cartilage thickness ratio

# Subject	# Male	# knee	Age (years)	BMI (kg/m <sup>2</sup> )
11 asymptomatic	11	22	31 ± 5	24 ± 2



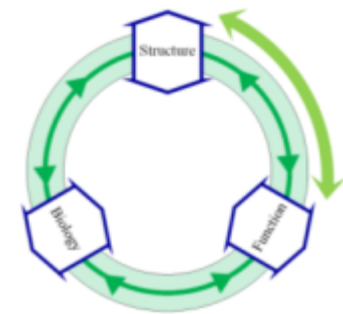
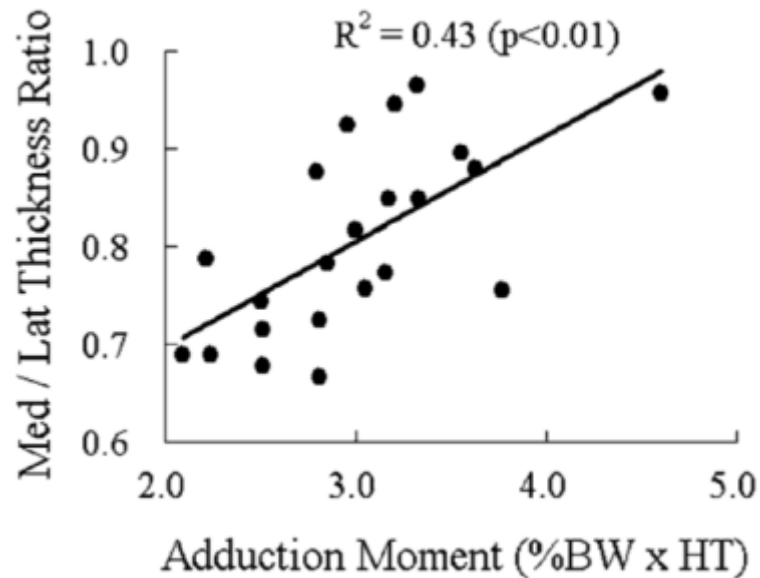
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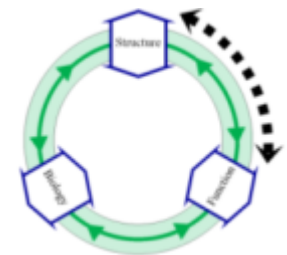
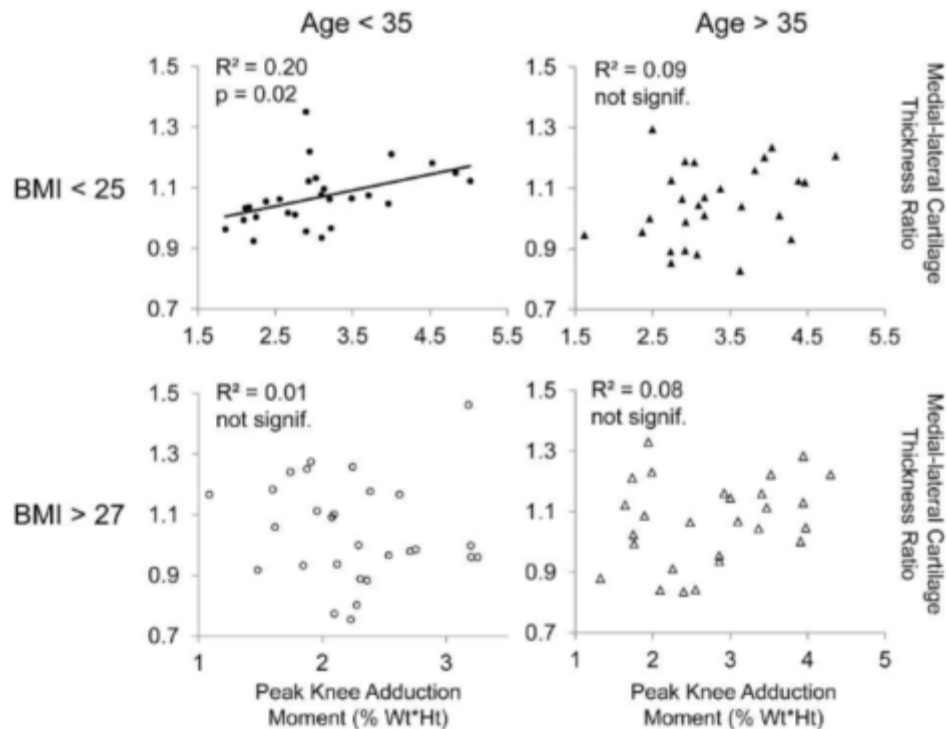




# KAM and M/L cartilage thickness ratio

	Number (% Women)	Age (Years)	Height (m)	Weight (kg)	BMI (kg/m <sup>2</sup> )
BMI < 25					
Young	28 (64)	28.0 (3.8)	1.71 (0.09)	64.1 (8.9)	21.9 (1.9)
Middle-aged	27 (59)	47.0 (6.5)	1.69 (0.08)	65.2 (7.6)	22.7 (1.7)
BMI > 27					
Young	28 (64)	28.4 (3.6)	1.69 (0.09)	94.6 (14.2)	33.3 (4.6)
Middle-aged	27 (33)	45.8 (7.2)	1.75 (0.09)	97.1 (13.5)	31.9 (4.4)

Values reported as mean (standard deviation). BMI, body mass index.

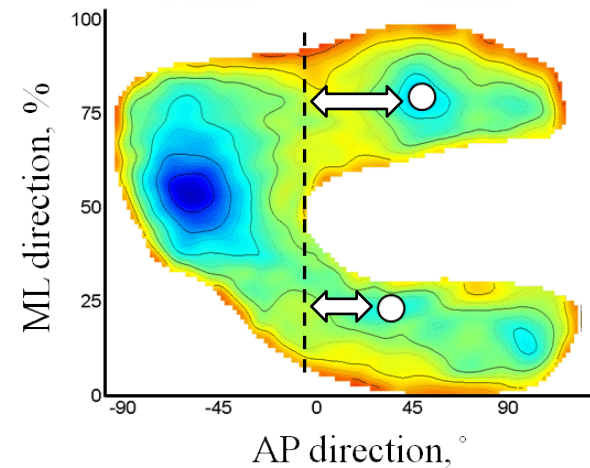
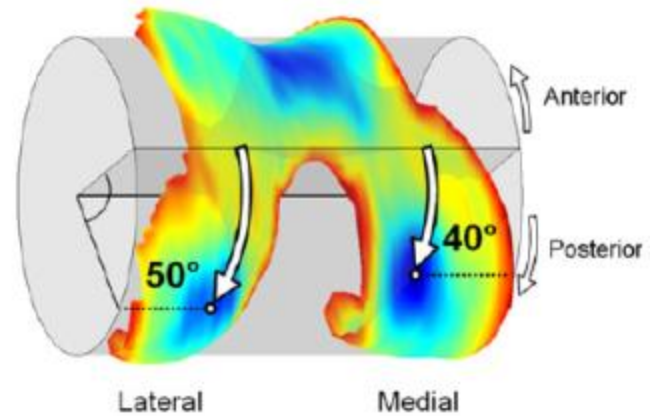
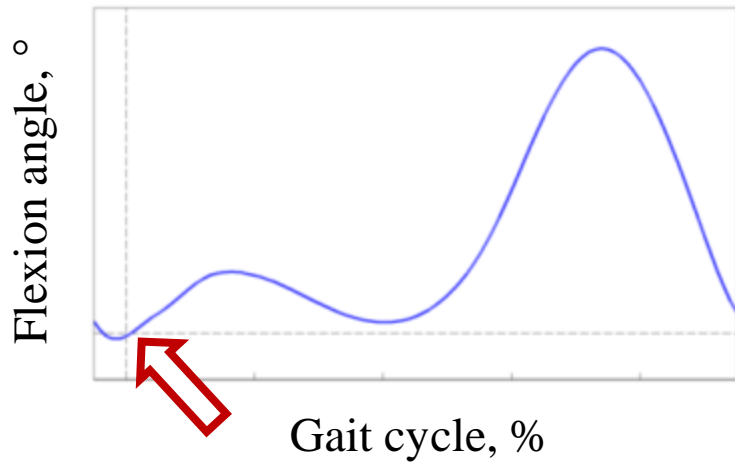


# KAM and M/L cartilage thickness ratio

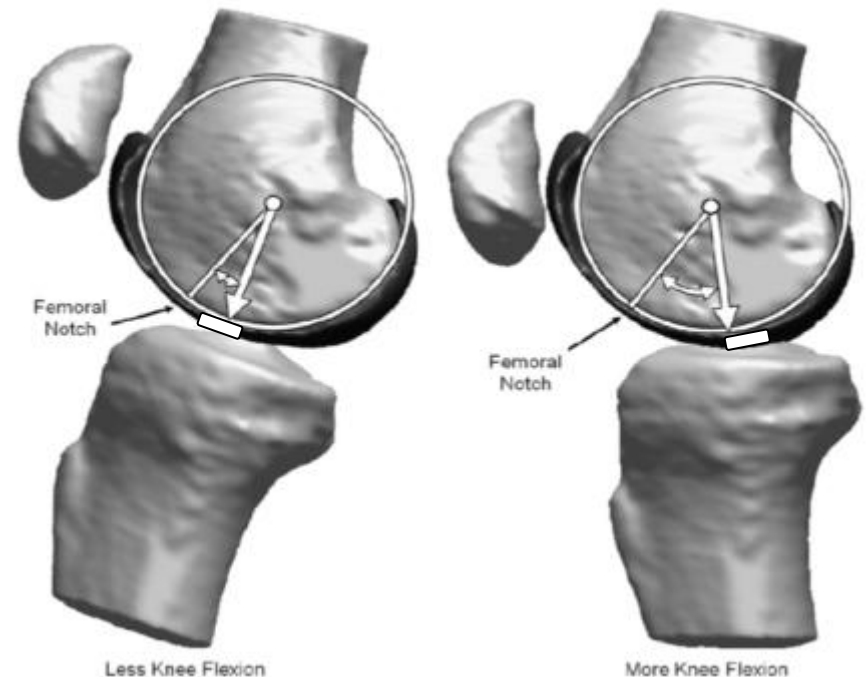
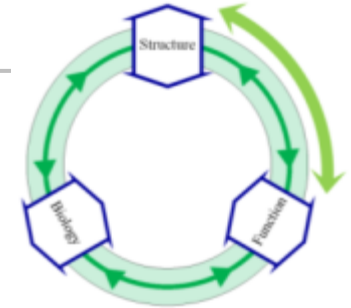
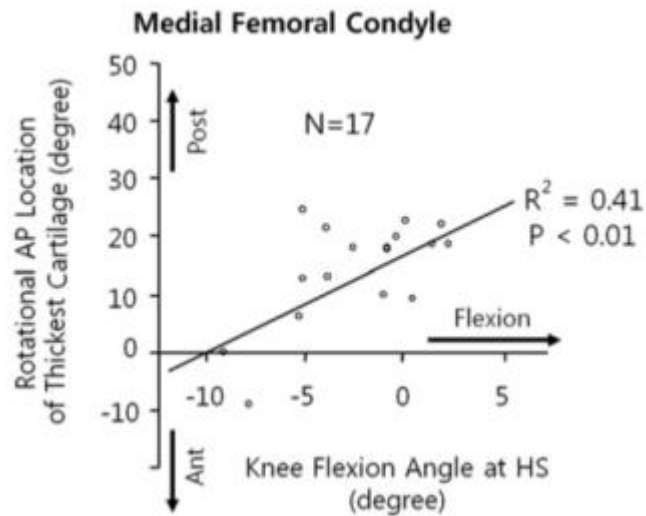
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# Flexion angle – thickest cartilage pt

# Knee	# Male	K/L Grade	Age (years)	BMI (kg/m <sup>2</sup> )
17 asymptomatic	10	2 [1 - 3]	33 ± 10	23 ± 2

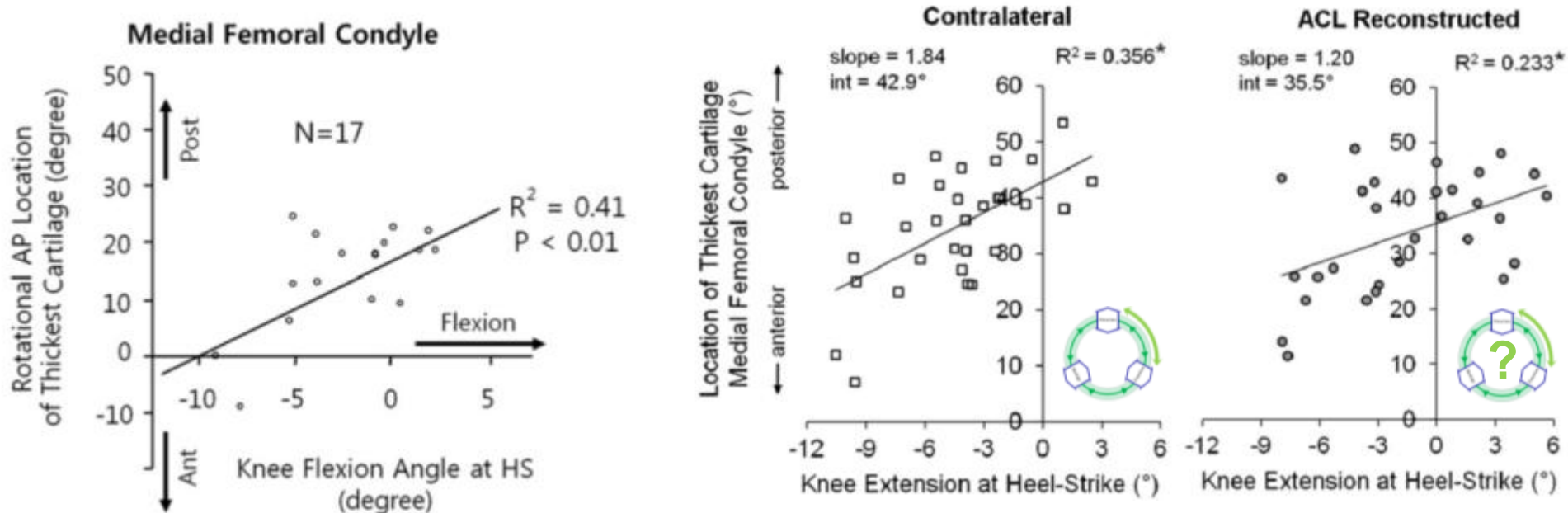


# Flexion angle – thickest cartilage pt



# Flexion angle – thickest cartilage pt

# Patients	Time past surgery (month)	# Male	Age (years)	Height (m)	Weight (kg)
29 unilateral ACLR	27 ± 4	15	29 ± 6	1.7 ± 0.1	73 ± 12



# Sagittal-plane knee function with aging and OA

Group	# Knee	# Male	Age (years)	Height (m)	Weight (kg)
Younger asymptomatic	29	17	29 ± 4	1.7 ± 0.1	80 ± 13
Older asymptomatic	27	15	57 ± 8	1.7 ± 0.1	78 ± 11
Older moderate OA	28	15	58 ± 9	1.7 ± 0.1	79 ± 15
Older severe OA	26	10	62 ± 10	1.7 ± 0.1	84 ± 16

## Asymptomatic subjects:

no self-reported pain or serious lower-limb injury

## OA patients:

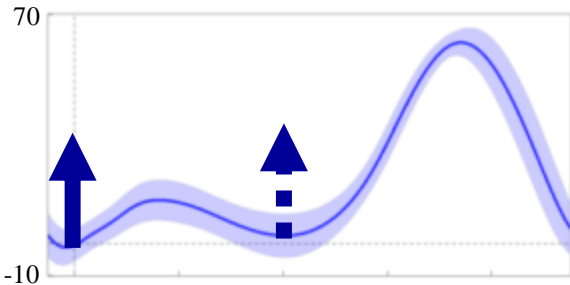
diagnosed medial OA, knee pain, and ability to walk without aids

moderate = KL grades 1 & 2

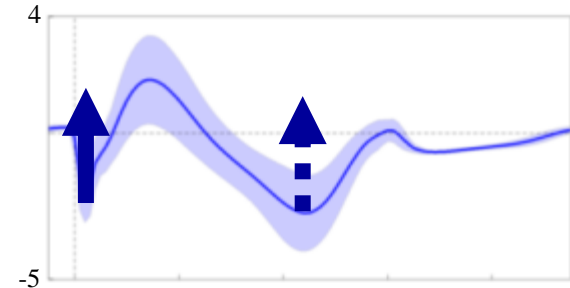
severe = KL grades 3 & 4

# Sagittal-plane knee function with aging and OA

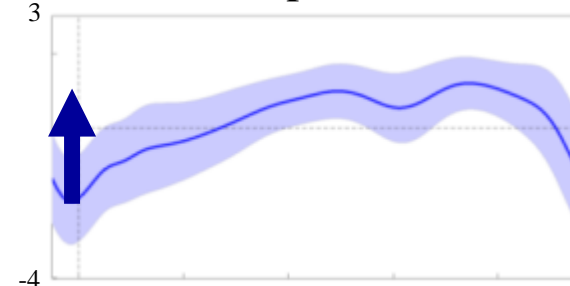
Flexion angle, °



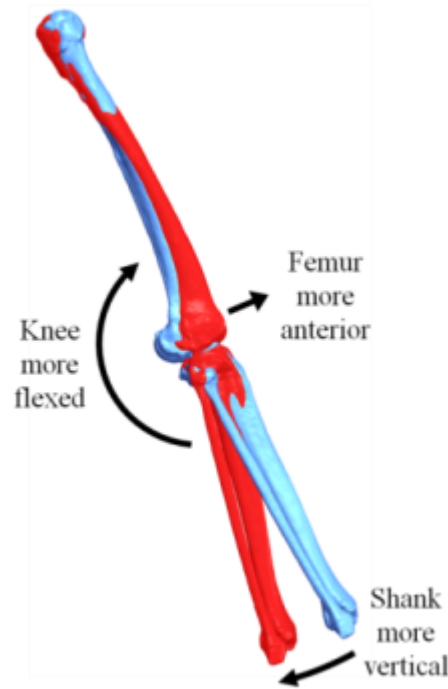
Flexion moment, %BW\*Ht



Anterior displacement, cm



Heel-strike  
(0% of gait cycle)

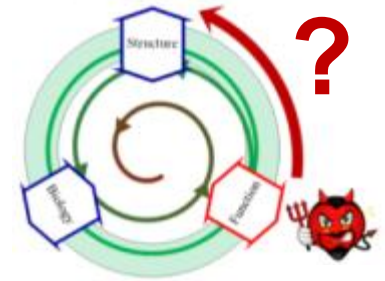


Younger asymptomatic Older severe OA

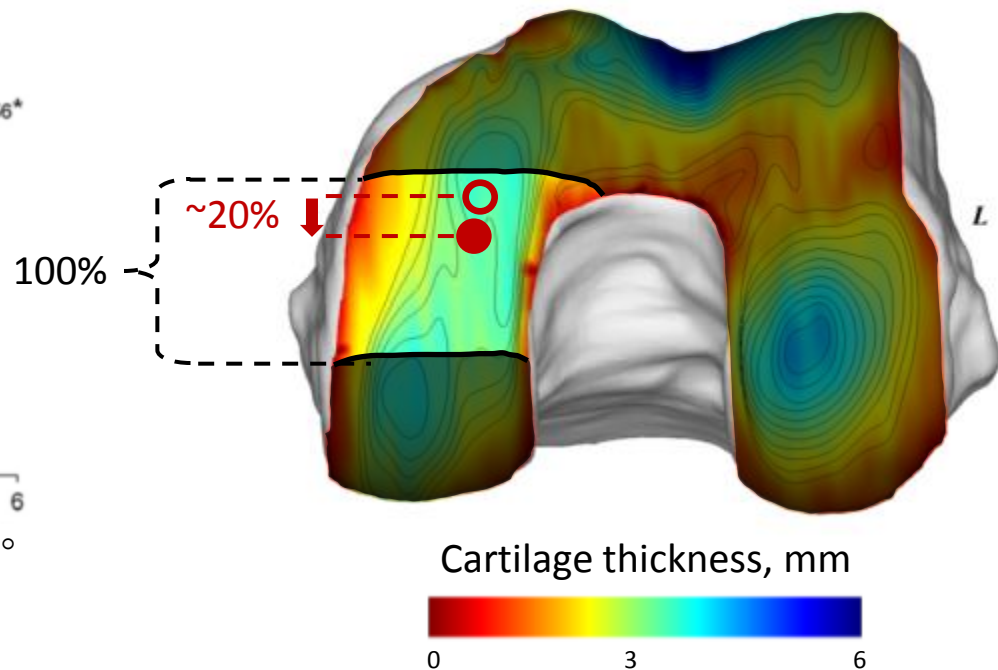
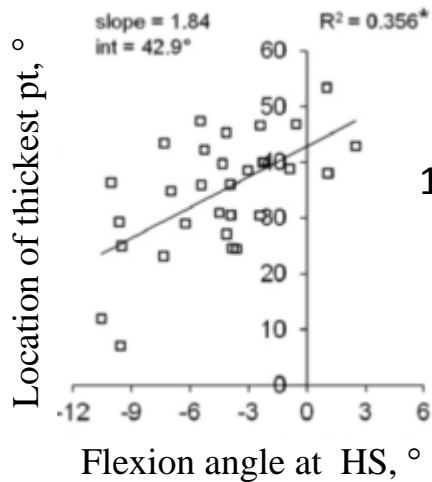
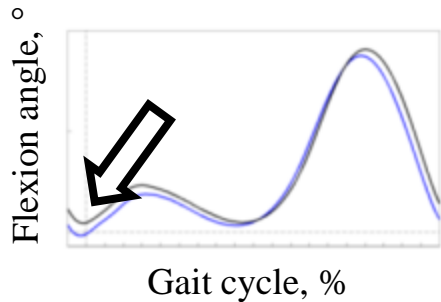


# Sagittal-plane knee function with aging and OA

Supports a kinematic pathway to knee OA

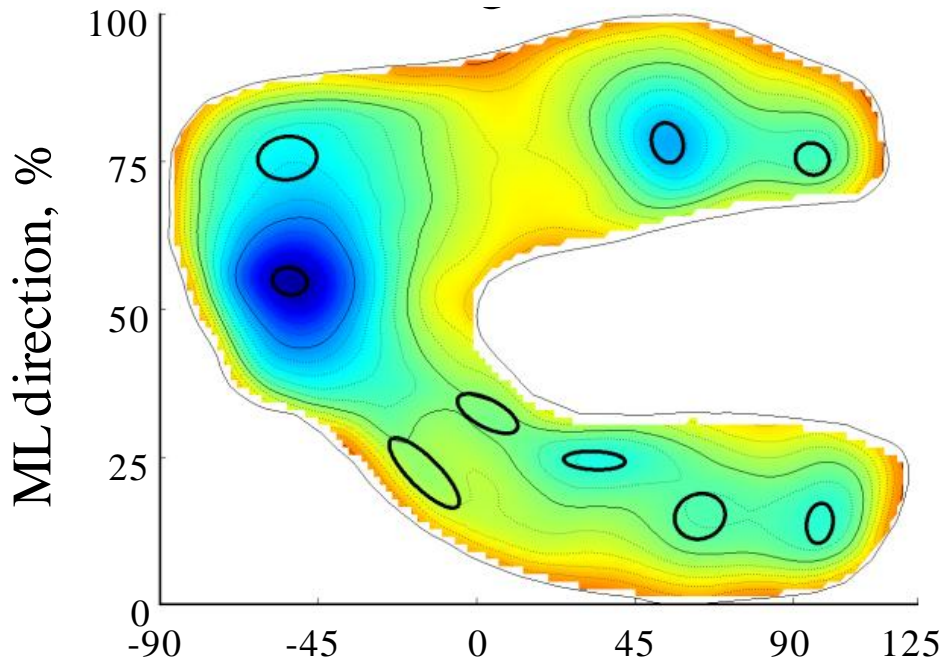


5° more flexed



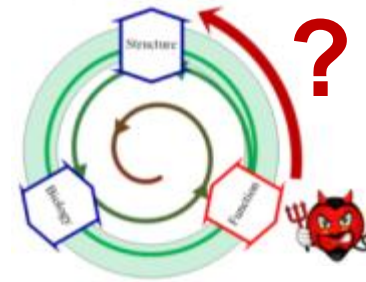
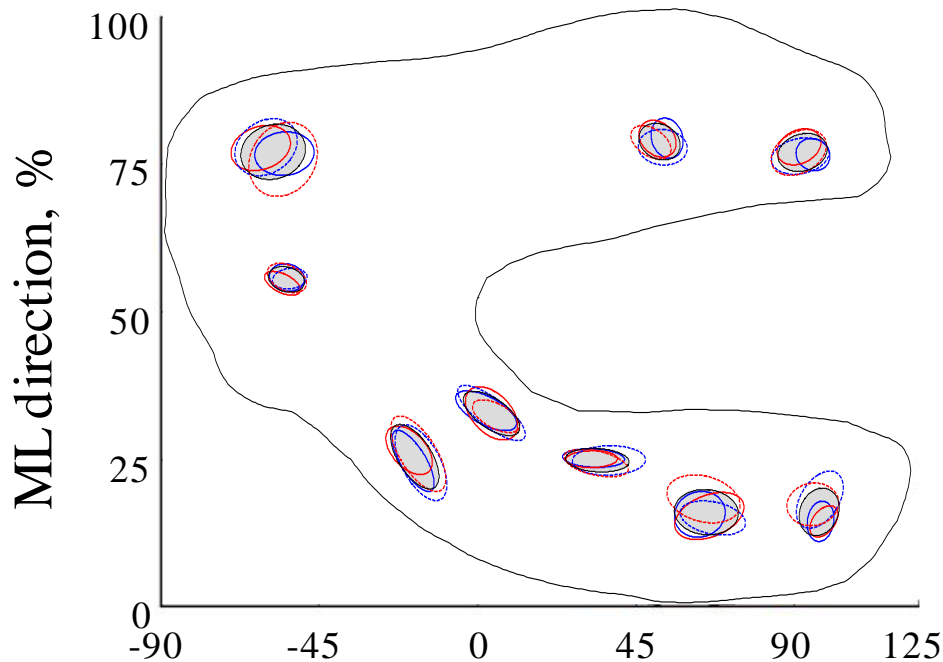
# Thickness cartilage pt with aging and gender

Group	# Knee	Side	Age (years)	Height (m)	Weight (kg)
Younger men	25	13 R	26 ± 3	1.8 ± 0.1	81 ± 11
Younger women	25	13 R	27 ± 4	1.7 ± 0.1	72 ± 11
Older men	25	13 R	58 ± 7	1.8 ± 0.1	82 ± 14
Older women	25	13 R	58 ± 6	1.6 ± 0.1	70 ± 10



# Thickness cartilage pt with aging and gender

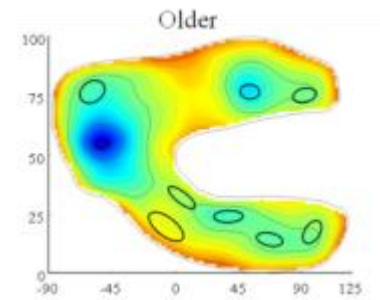
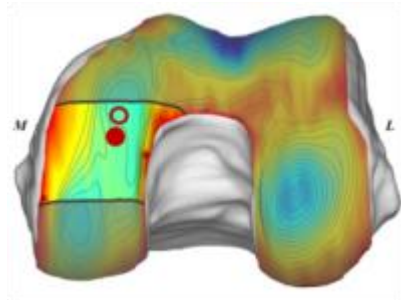
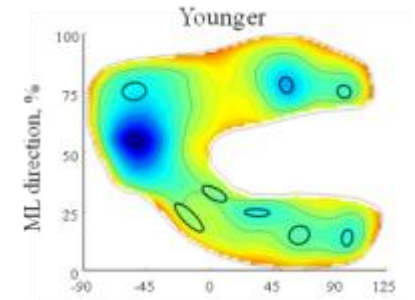
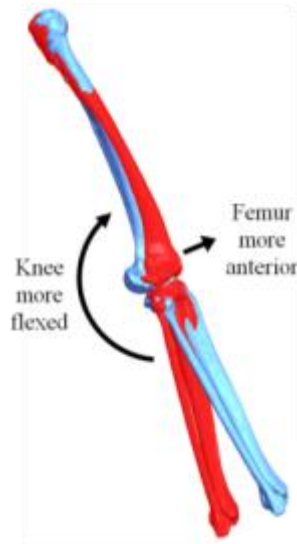
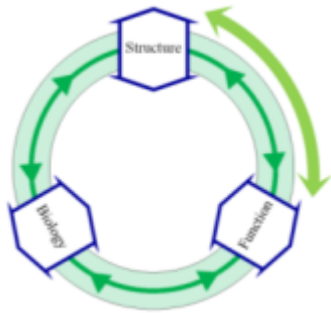
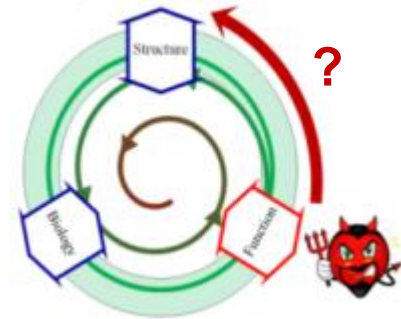
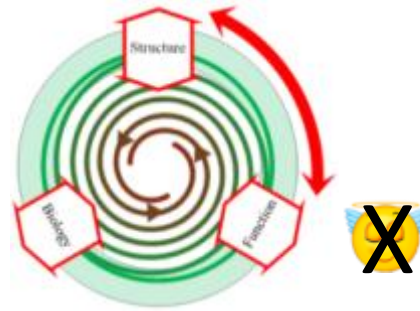
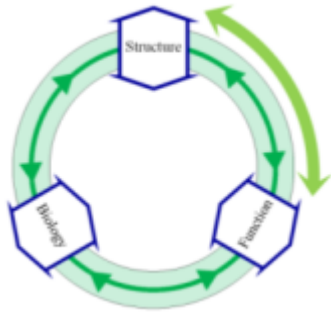
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# Knee function – 5 year $\Delta$ thickness

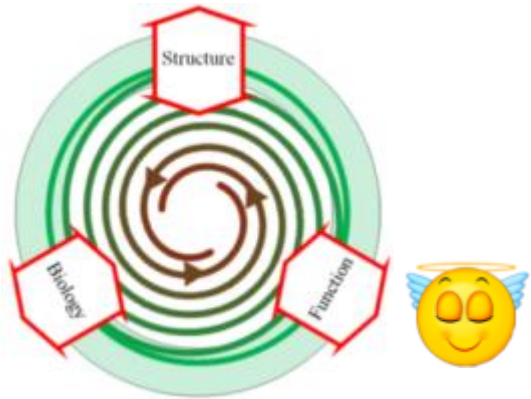
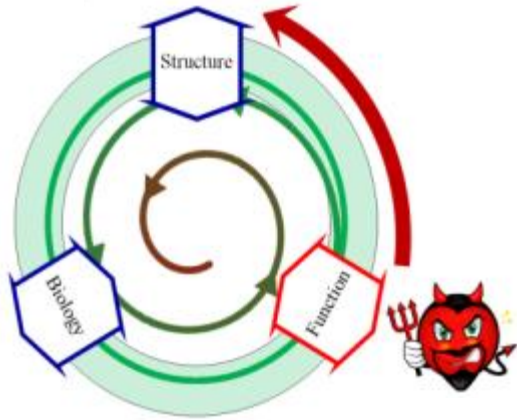
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# Summary



**Older  
severe OA**

# Conclusion



- Knee function at heel-strike of walking might play a role in idiopathic OA initiation
- Need a better understanding of the response, not only differences or associations
- Need to test/consider other variables → need a system approach
- The disease is very complex and we can act on the knee function

# Some options to modify the ambulatory knee function



See More...

**Size**

6.5	7	7.5	8	8.5	9	9.5	10
10.5	11	11.5	12	12.5	13		

**Featured**

New Arrivals (30)  
Exclusively Dem (30)

**Color**

Black	Blue	Green	Grey	White
Yellow	Purple	Red	Orange	Light Grey
Dark Grey	Light Grey	White	White	White

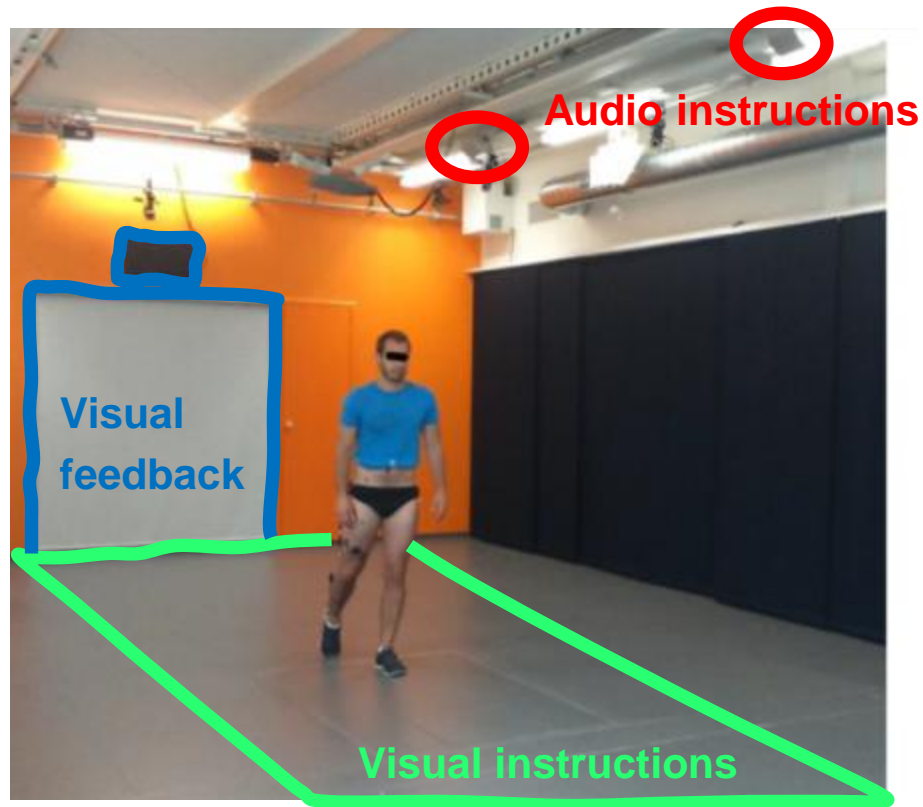
**Style**

Adjustable Straps (21)  
Lace Up (11)  
Removable Footbed (30)  
Slip On (10)  
Mary Jane (14)  
Heel Height: Low (113)  
Heel Height: Medium (4)

Doriko Sherla \$175.00 ★★★★★	Doriko ProSP \$140.00 ★★★★★	Doriko Eton \$95.00 ★★★★★	UC 24-7 Mason \$94.00 ★★★★★
Doriko ProSP \$189.00 ★★★★★	ABO 3600 \$139.00 ★★★★★	Kings Naples \$114.00	Kings Carolina \$209.00
Kings Naples	Doriko Sherla	Doriko Eton	Doriko ProSP



# Individual gait modification



# Acknowledgements

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Dr. Sean F. Scanlan

NIH, VA, AF, SNSF