Equine Hoof Biomechanics

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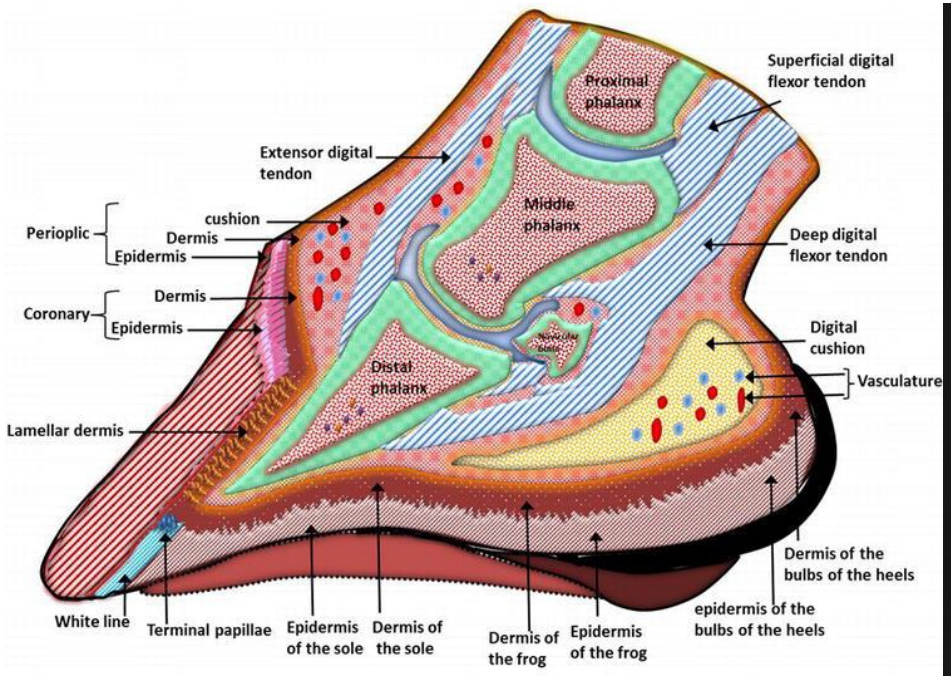
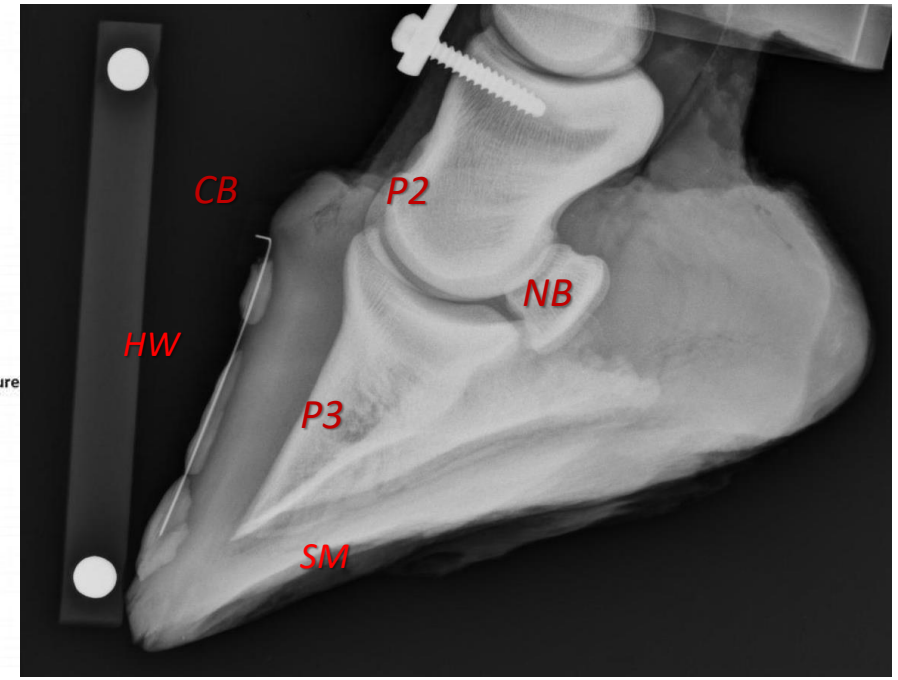
Equine Hoof Anatomy

- The equine hoof covering the distal portion of each limb plays a great role in the weight bearing and biomechanics.

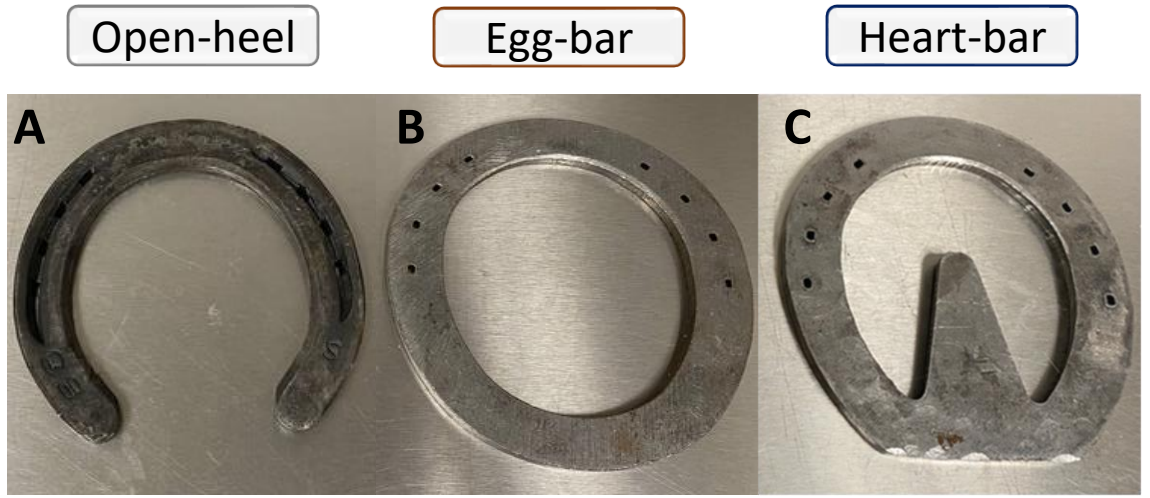


Budras et al.



Horseshoe Effects in Hooves

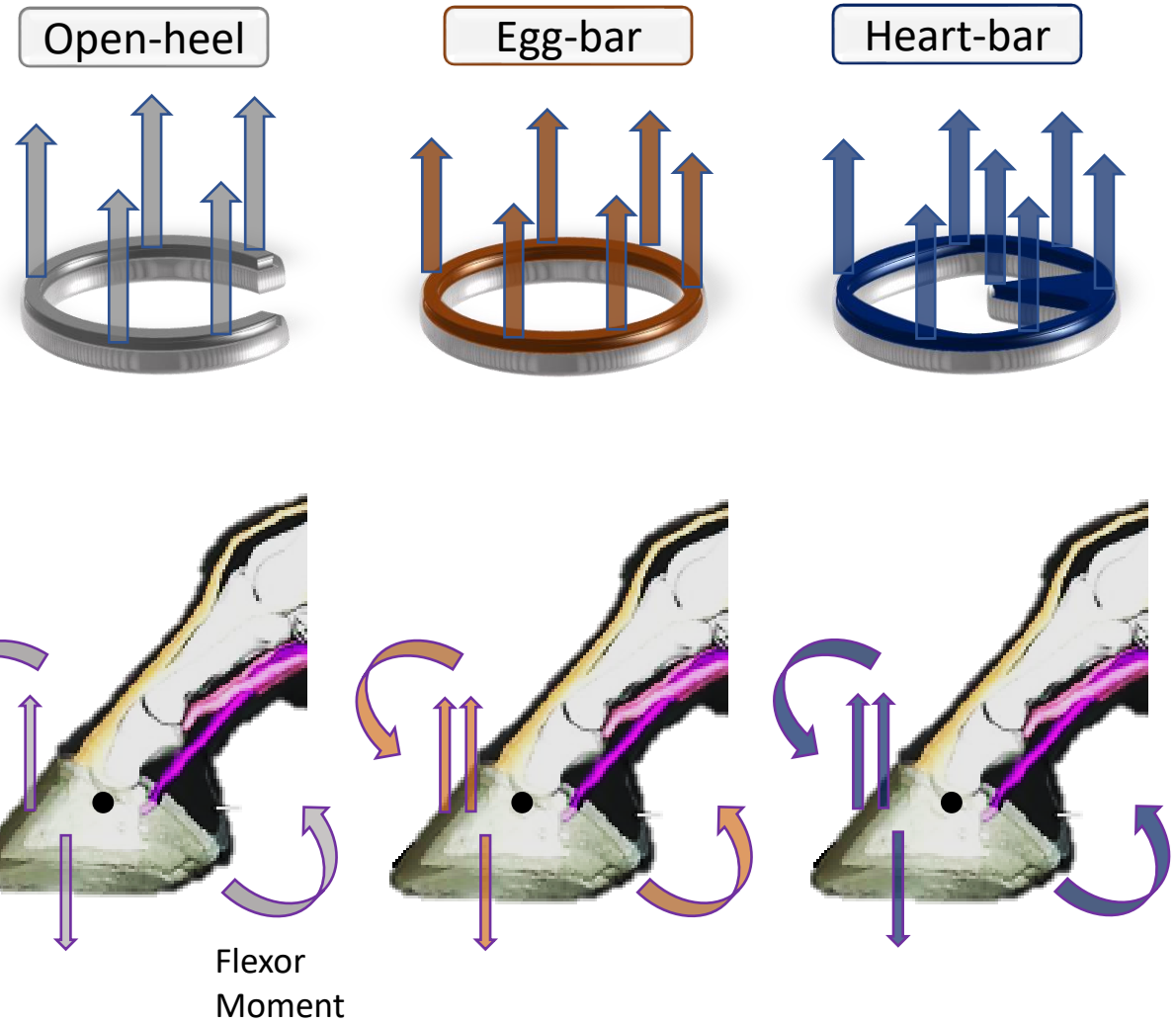
- Biomechanical aid after proper trimming
- Supporting and stabilizing
- Distinctive redistribution of weight
- Relief of lamellar stress and compression



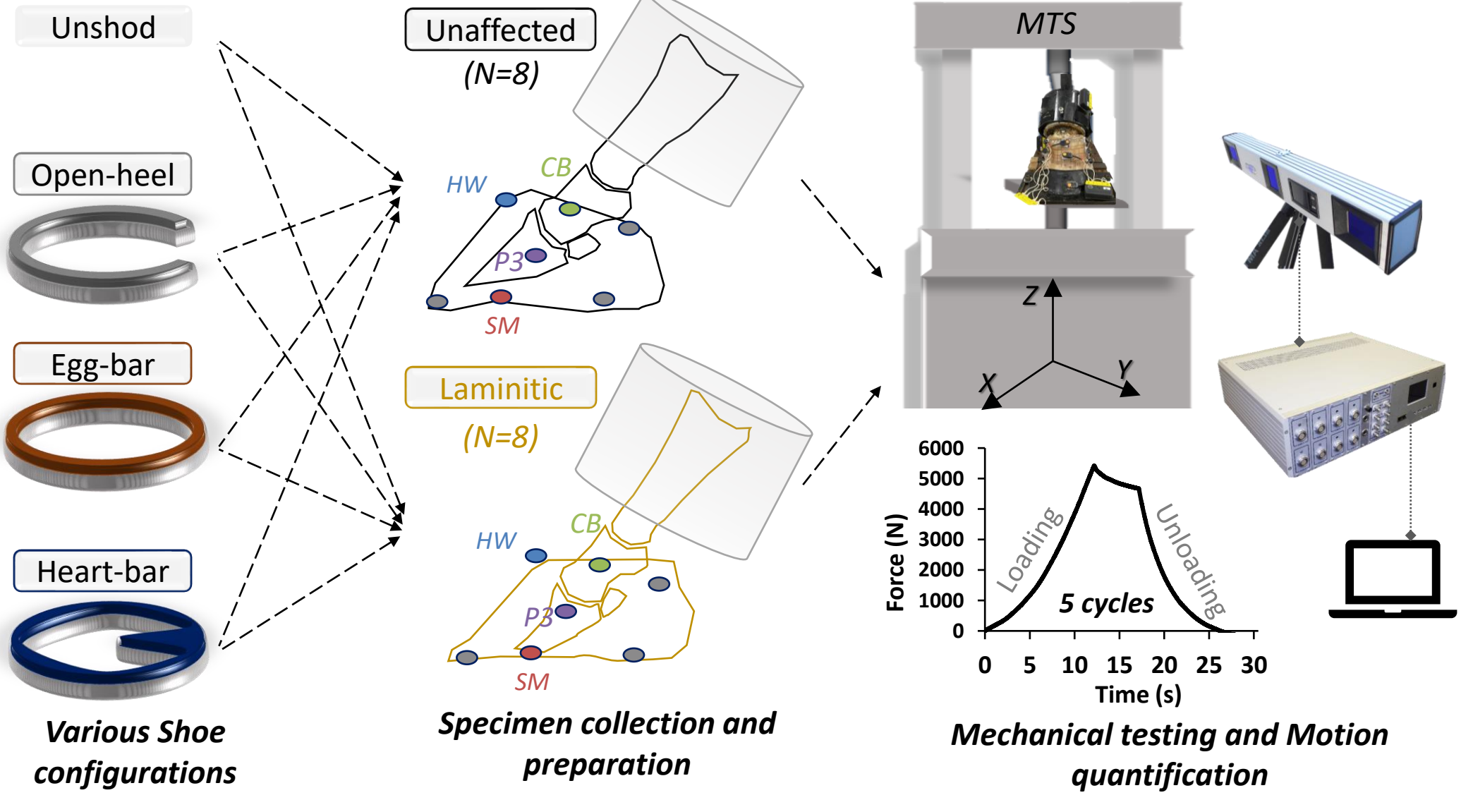
Load Distribution Changes with Shoes

- Open-heel supports the toe
- Egg-bar supporting wall and heel
- Heart-bar supporting wall and frog

➢ Limited knowledge about P3 motion in hooves with the different shoe configurations.



Study Design

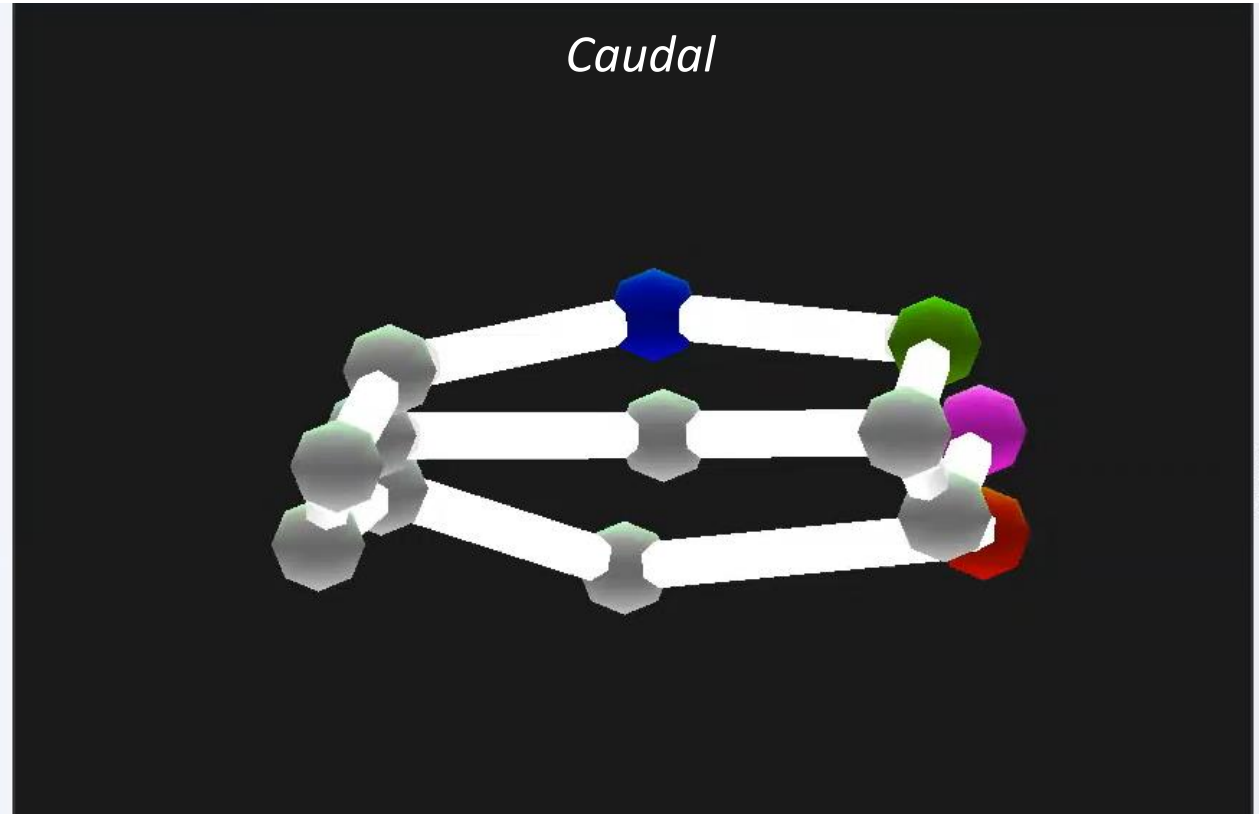


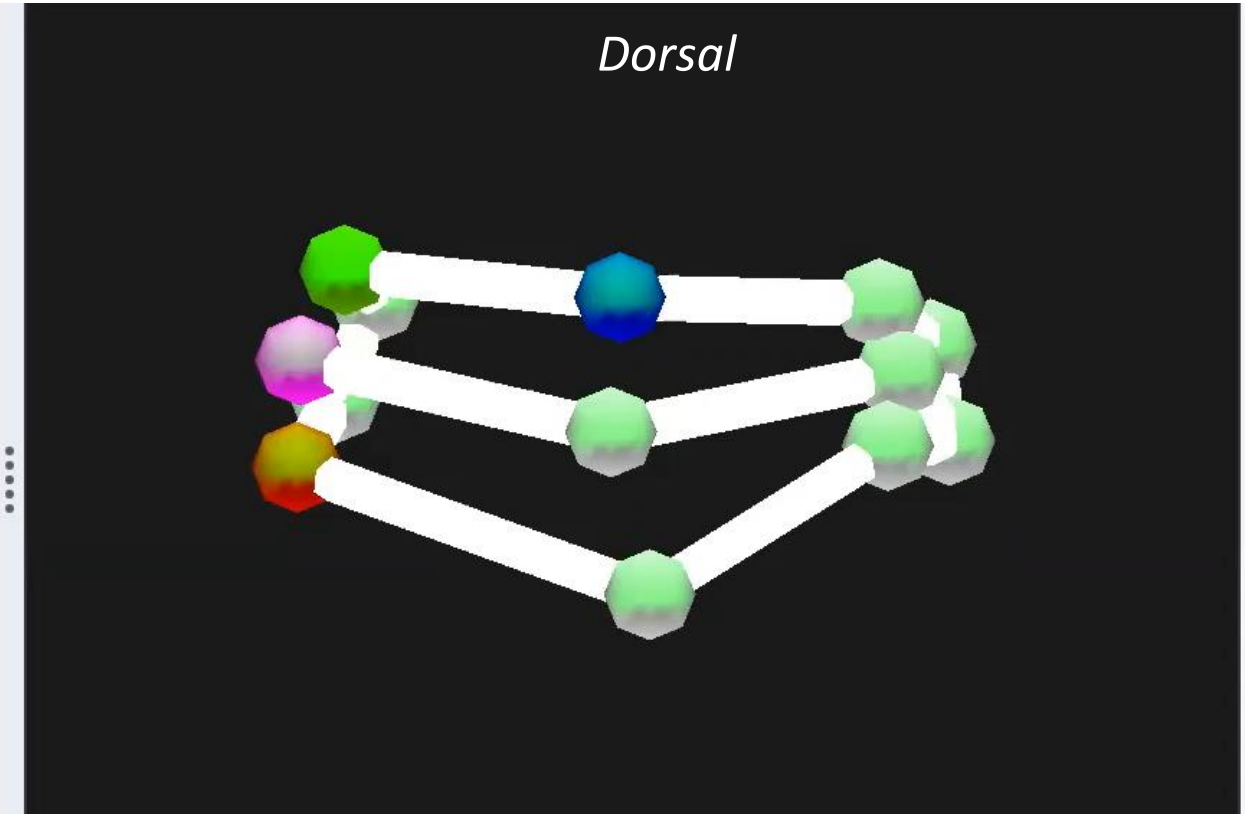
Various Shoe configurations

Specimen collection and preparation

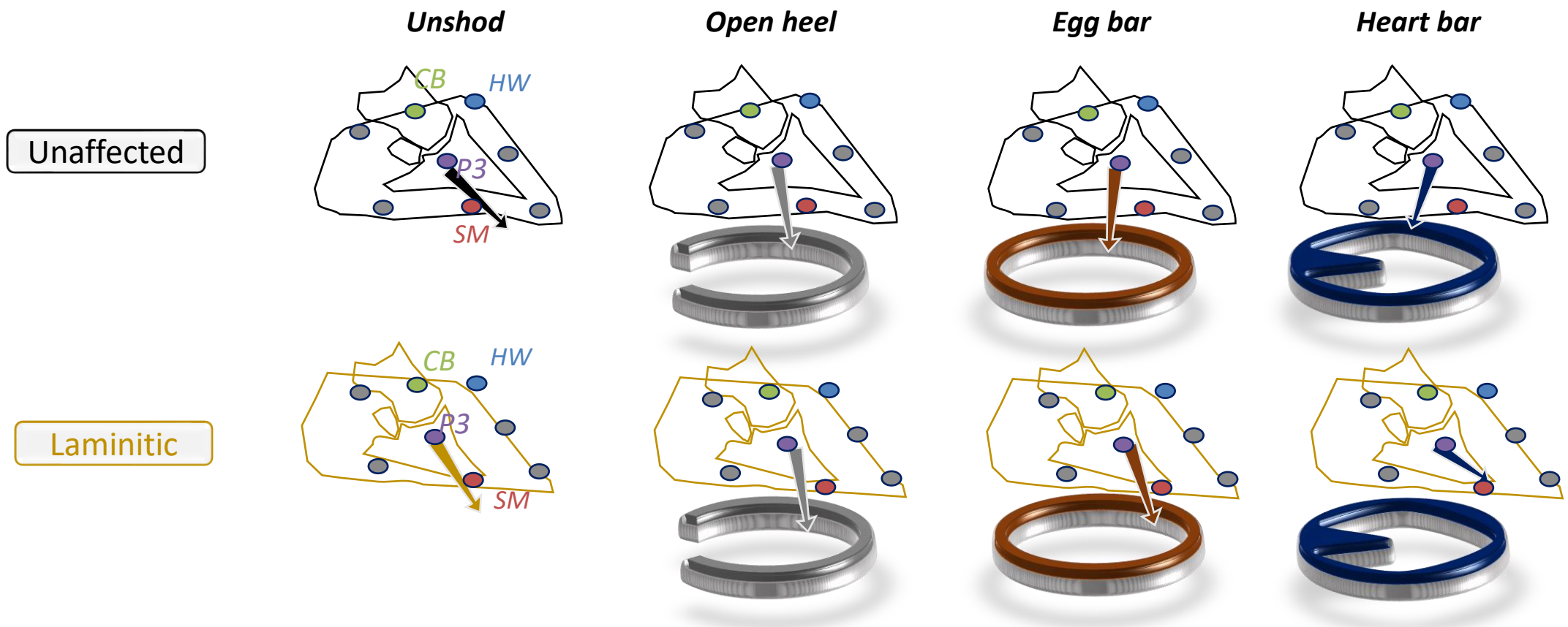
Mechanical testing and Motion quantification

Compression of the Hoof During the Load



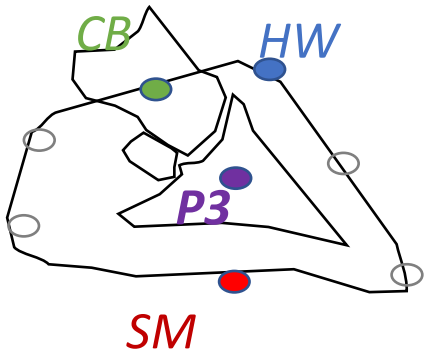


Direction of P3 Motion changes with shoes

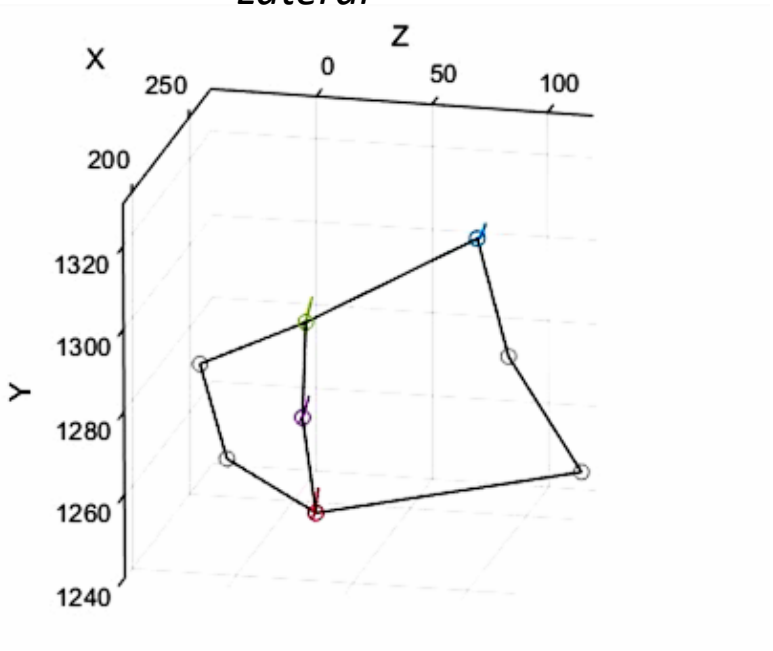


- Heart-bar shifts P3 motion towards the frog of unaffected hooves but towards the toe of laminitic hooves

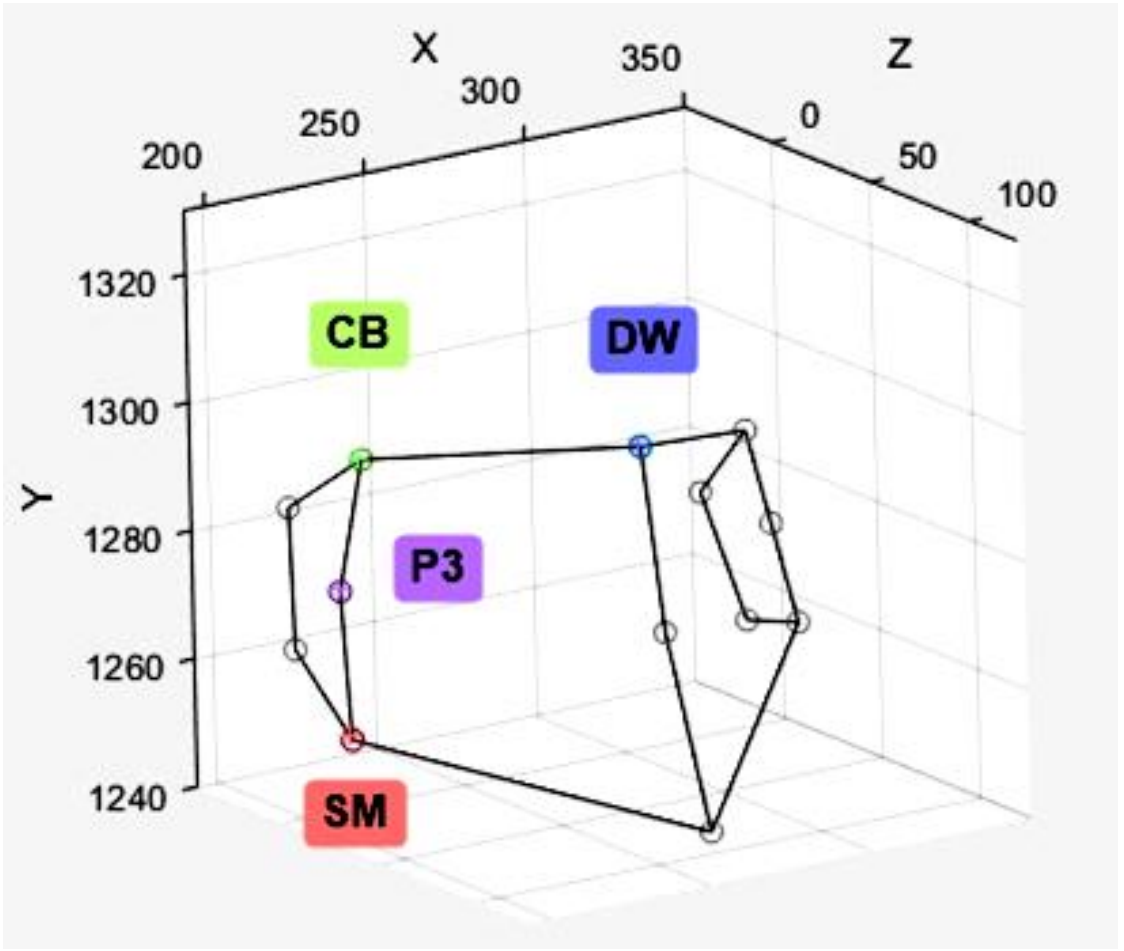
Animated Model of Hoof Components' Motion in Unaffected Hooves



Lateral



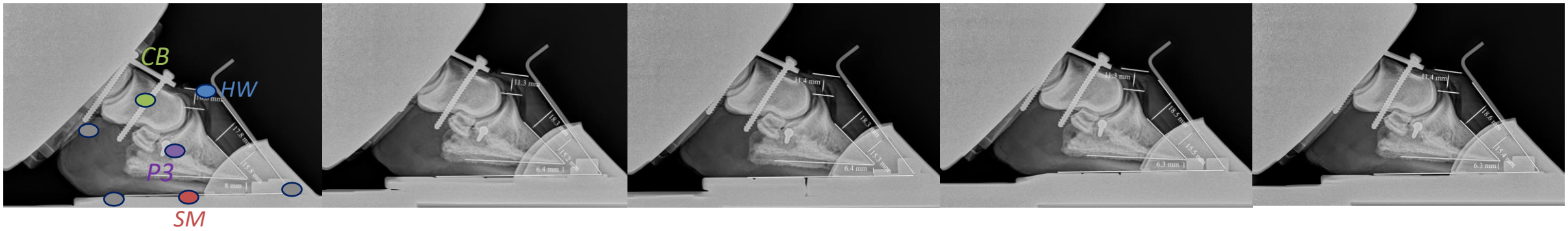
Quasi-Dorsal



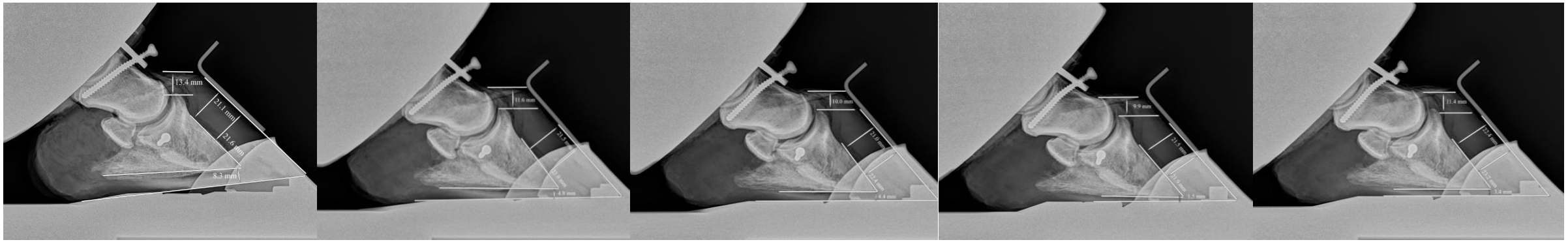
Third Phalanx Rotation in Unaffected Hoof

100 N | 1375 N | 2750 N | 4125 N | 5500 N

Unaffected



Laminitic



How does the data look like?

	DW			SM			CB			P3 Lateral			P3 Medial		
Time	Marker 09.	Marker 09.	Marker 09.	Marker 12.X	Marker 12.	Marker 12.	Marker 10.	Marker 10.	Marker 10.	Marker 11.X	Marker 11.	Marker 11.	Marker 05.	Marker 05.	Marker 05.Z
(s)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
0	257.678	1300.778	66.717	188.832	1257.074	48.904	192.746	1290.5	24.175	188.456	1273.28	35.236	307.584	1273.957	42.046
0.005	257.678	1300.778	66.717	188.832	1257.074	48.904	192.746	1290.5	24.175	188.456	1273.28	35.236	307.584	1273.957	42.046
0.01	257.88	1300.748	67.004	189.203	1257.074	48.634	192.822	1290.522	24.094	188.706	1273.32	35.058	307.993	1273.919	42.502
0.015							192.625	1290.476	24.332						
0.02															
0.025															
0.03															
0.035															
0.04															
0.045															
0.05															
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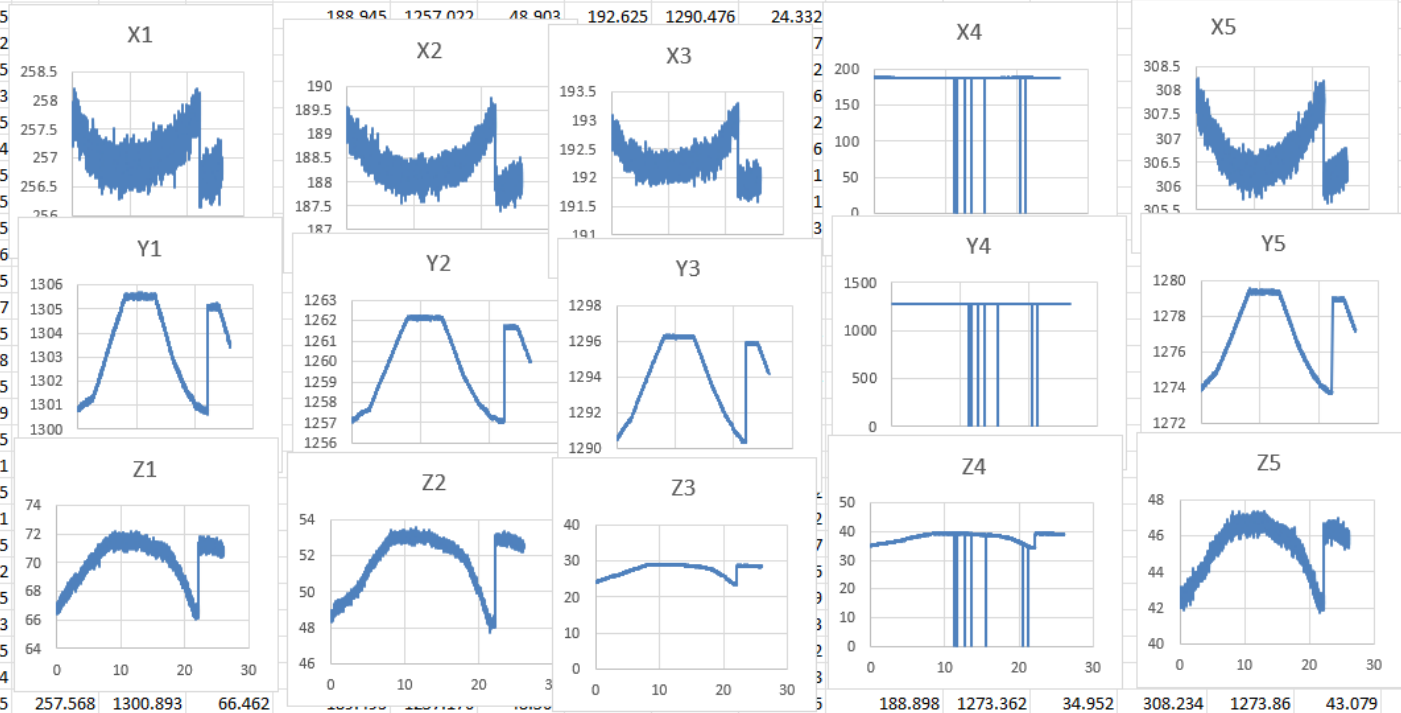
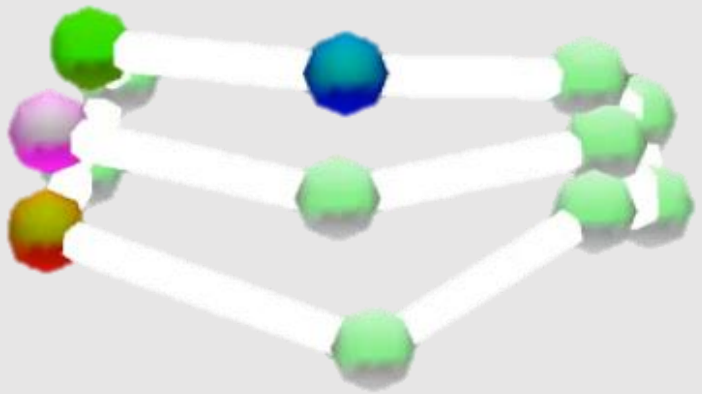
0.12															
0.125															
0.13															
0.135															
0.14															
0.145	257.568	1300.893	66.462							188.898	1273.362	34.952	308.234	1273.86	43.079
0.15	257.802	1300.784	66.969	189.1	1257.064	48.938	192.764	1290.569	24.257	188.608	1273.323	35.24	307.798	1273.952	42.448
0.155	257.694	1300.76	67.215	189.245	1257.134	48.691	192.616	1290.506	24.411	188.641	1273.271	35.16	307.976	1273.992	42.736



Live Motion Acquisition – Gait Analysis

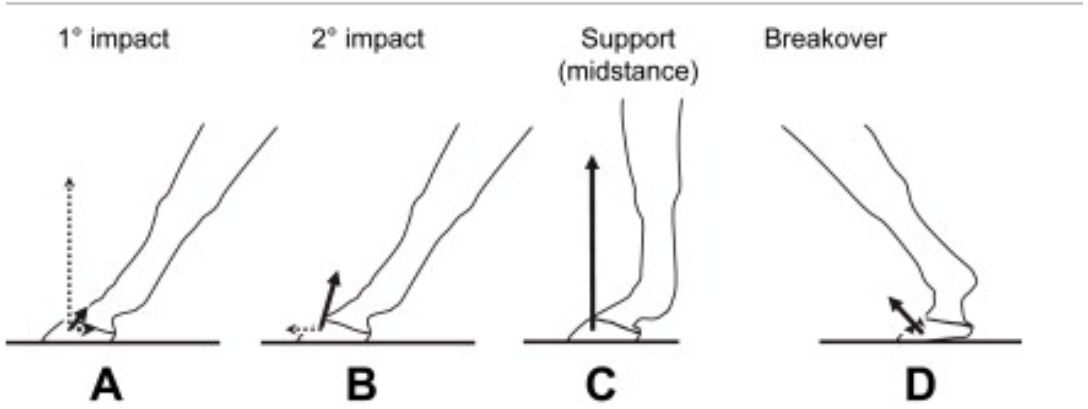
Questions?

Thank you!



Strain change in-vivo

Thomason, J. J., & Peterson, M. L. (2008).



Composite figure shows patterns of force, acceleration, and strain acting on the hoof during the stance and into the first period of breakover for acceleration and strain. (*A*, *B*) Vertical and horizontal (craniocaudal) components of GRF act on the hoof during the stance. The means of five stances are shown for a single horse trotting across a force plate. (*C*, *D*) A_V and A_H. A single stance is shown for a standardbred trotting on a track. (*E*) Principal compressive strain in the material of the hoof wall at the toe. (Data for A and B *courtesy of* Dr. Hilary Clayton, Lansing, MI; data for C through E *courtesy of* J. J. Thomason, PhD, Guelph, Ontario, Canada.)