

A COMPARATIVE STUDY OF THE LOAD DISTRIBUTION OF THE BEARING SURFACE OF THE EQUINE FOOT BETWEEN AN OPEN HEELED SHOE WITH A CAUDAL SOLE PACK AND A HEART BAR SHOE ALONE

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INTRODUCTION

This study is concerned with the progression of techniques used in farriery. The advent of modern materials have opened up new ways of addressing pathologies that can exceed the expectations of the past. A pour in sole pack mimics the properties of the frog and digital cushion. It has the potential to enhance functionality and increase surface area while at the same time providing greater support. The heart bar shoe is site specific with no flexibility and the possibility of damage, pain and infection of the sensitive structures beneath (O'Grady 2008)



HEART BAR SHOE IN SITU

Foot mapping on the foot used in the study

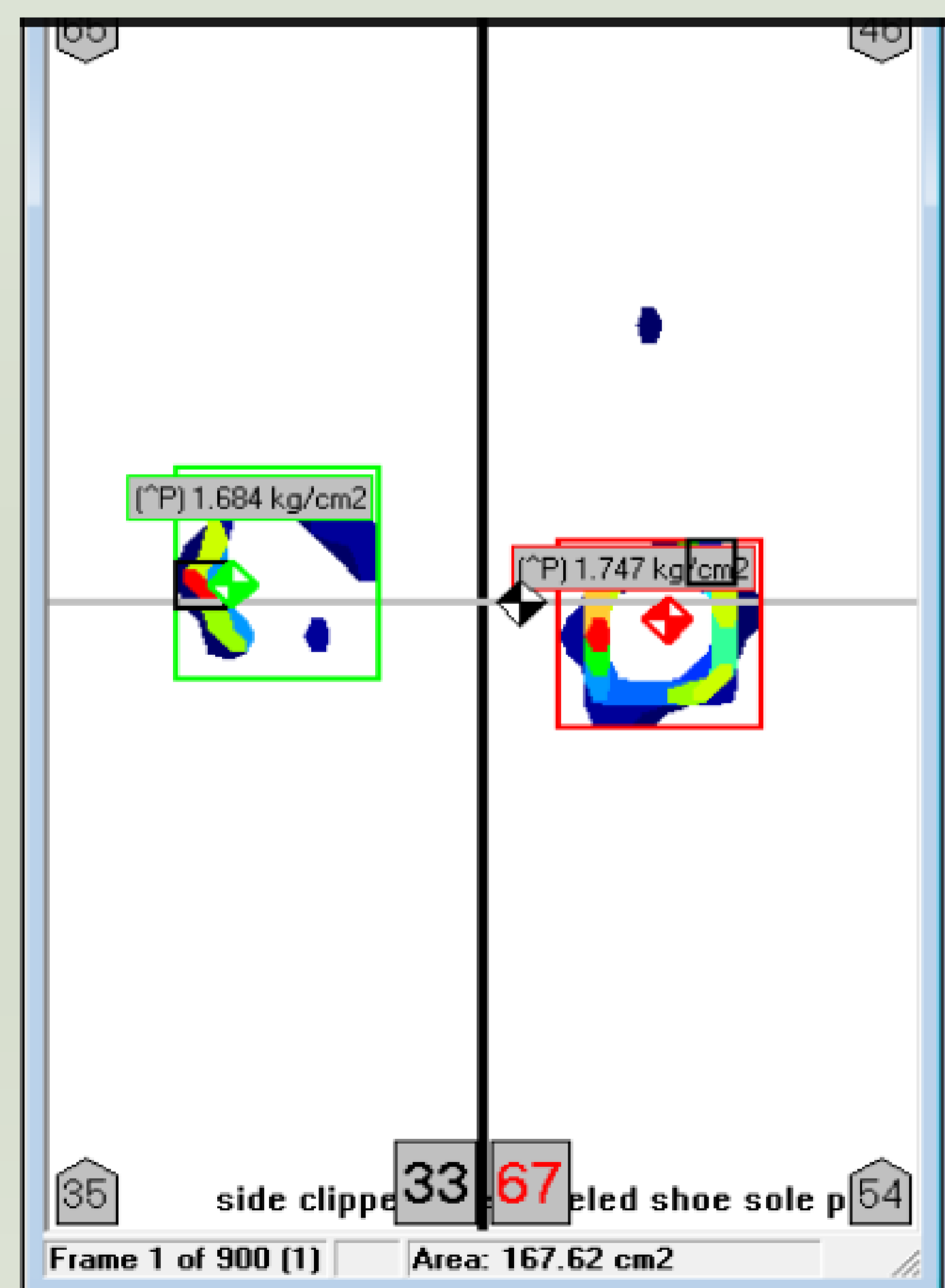
Werkman Warrior shoe with caudal sole pack and playdoh in the toe to stop flooding the dorsal half of the foot which was taken out later

HYPOTHESIS

The hypothesis of this study was that a caudal sole pack is more beneficial than the use of a heart bar shoe alone.

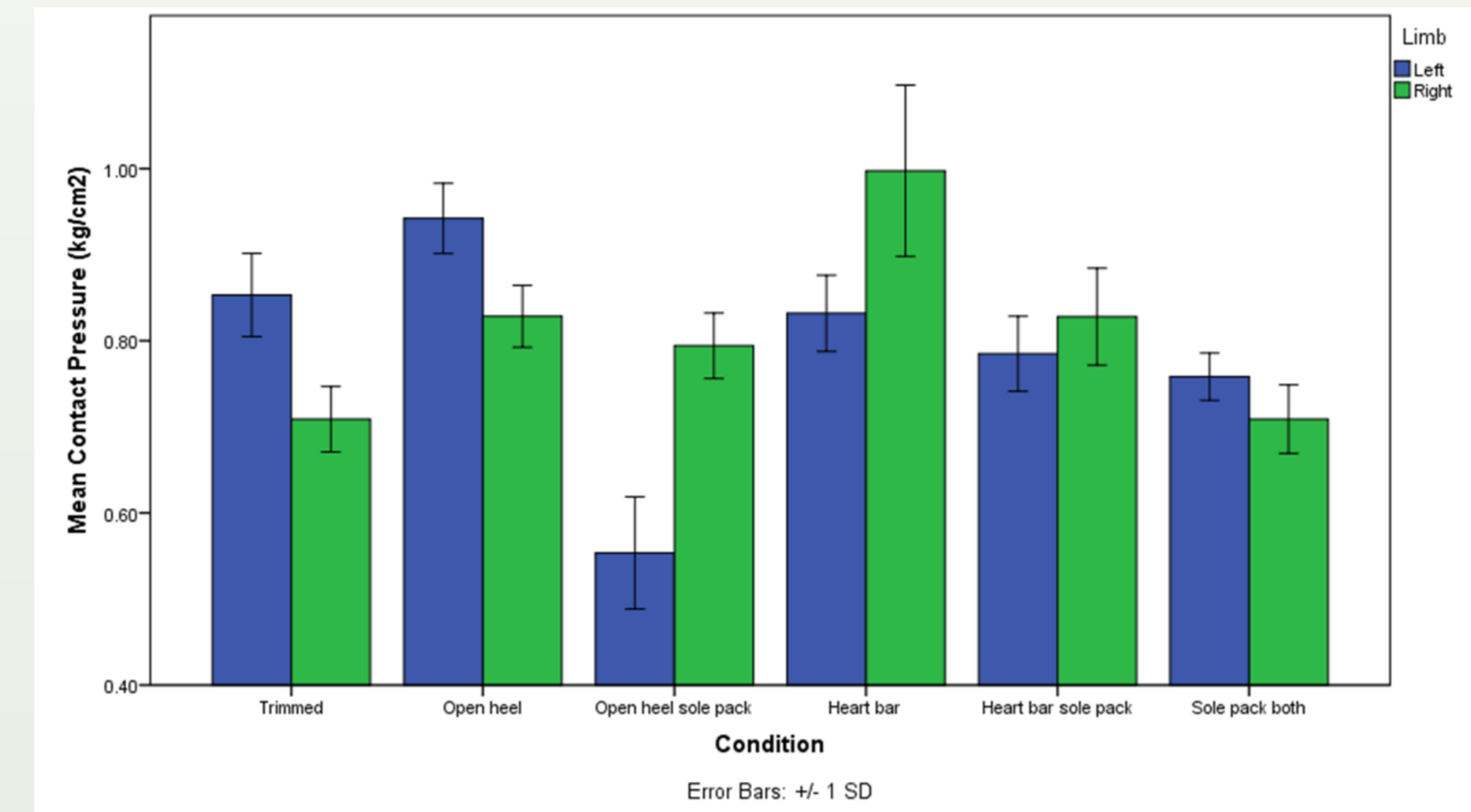
METHOD

One horse was used as its own control. The feet were trimmed to the research protocol established by (Caldwell et al 2010) then a pair of commercially available shoes (Werkman Warrior Specials) fitted. The right fore had all the interventions applied to it whilst the left fore remained the same as a comparison. At all interventions, trimmed, open heel, heart bar and caudal sole pack the horse was stood on the pressure mat and data recorded onto a laptop computer. Data then were run through Minitab, a statistical programme, and ANOVA and a paired t test results produced.

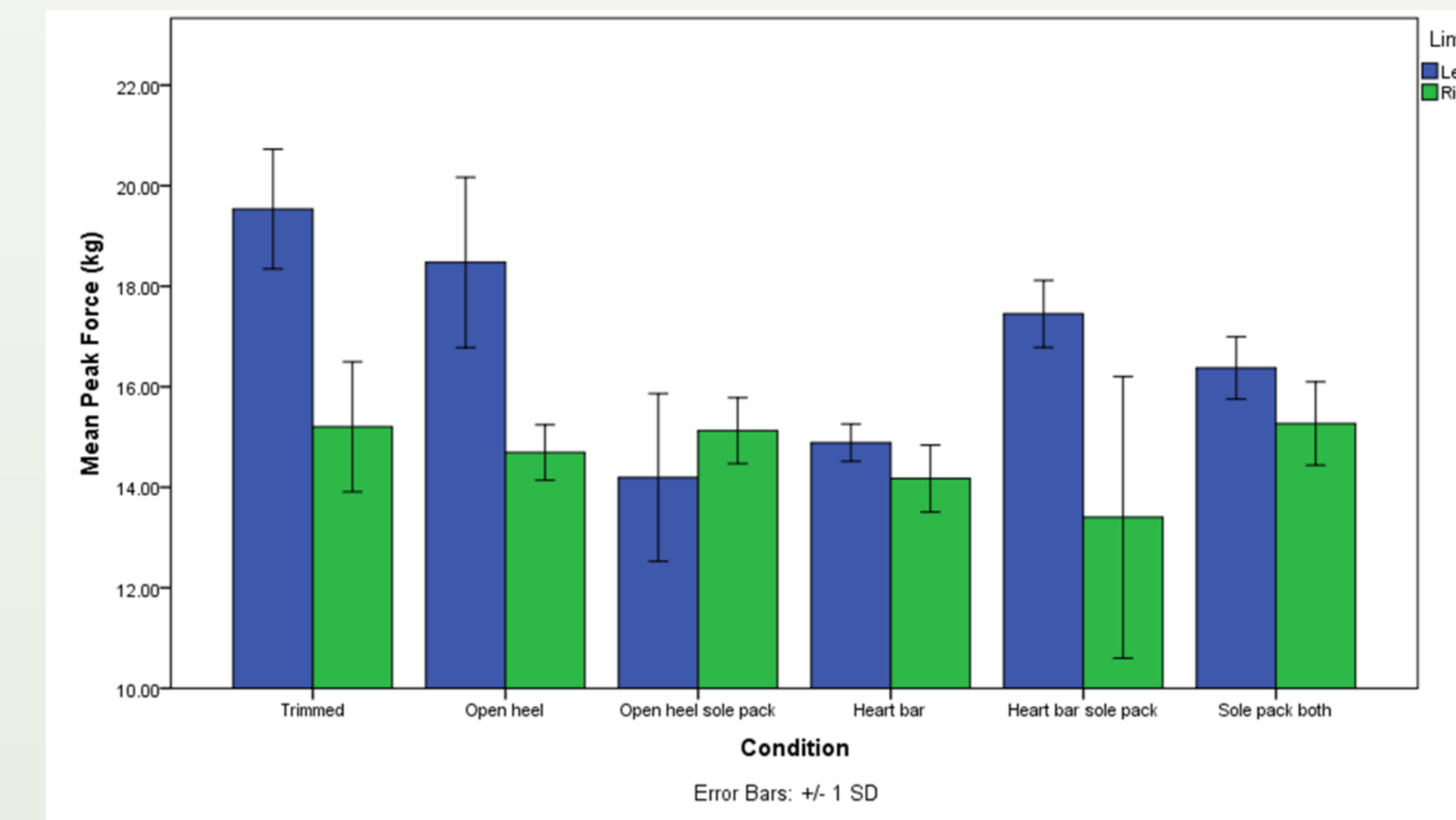


Pressure mat images produced indicating areas of pressure. The diamonds indicate centre of pressure for each foot. Pressure readings indicated in grey boxes

RESULTS



Note the increase in contact pressure in the heart bar which is at variance with the peak force



Note the fluctuations in the heart bar with sole pack, right foot column error bar which indicate reluctance to bear weight.

Heart Bar

	Paired Differences				t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower				Upper
Pair 1 Peak_Force_L-Peak_Force_R	.71198	.72514	.02417	.68454	.75942	29.455	.899	.000
Pair 2 Contact_Pressure_L-Contact_Pressure_R	-1.6557	.11368	.00378	-1.7301	-1.5813	-43.691	.899	.000

A significantly greater Peak Force can be seen in the left fore than the right (t=29.46, df=899, P<0.001). The Contact Pressure is greater in the right fore (t=43.69, df=899, P<0.001)

Open heel with sole pack

	Paired Differences				t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower				Upper
Pair 1 Peak_Force_L-Peak_Force_R	-.93333	1.36223	.04541	-1.02245	-.84422	-20.555	.899	.000
Pair 2 Contact_Pressure_L-Contact_Pressure_R	-.24075	.06708	.00224	-.24514	-.23636	-107.669	.899	.000

When the sole pack was applied to the right fore the horse's limb preference reversed with a significantly higher Peak Force now being seen on the right limb (t=-20.56, df=899, P<0.001) coupled with a significantly higher Contact Pressure (t=-107.699, df=899, P<0.001)

CONCLUSION

The set of data produced from the pressure mat in this study provided sufficient evidence to indicate that the use of a heart bar was questionable. Data suggested the horse was more comfortable with a caudal sole pack. It indicated a reluctance to weight bear on the heart bar which could lead to being less ambulatory and therefore the hoof being less functional, which is detrimental to the welfare of the hoof. Pour in hoof packing is a speedy way to administer first aid at a moments notice without having to go and make a heart bar shoe or order a heart bar shoe in. It provides increased area of contact thus reducing Kg/cm² pressure on the solar surface of the hoof. It is going back to enhancing and mimicking the natural substances of the foot and working with it's form and function and providing comfortable and more fuller support.

Condition	Averaged Contact Frame 1-900											
	Force (Kg)		Contact Area (cm ²)		Contact Pressure (kg Peak Force (kg))		Peak Con Press (kg c % force)					
	Left	Right	Left	Right	Left	Right	Left	Right				
As Presen	81	88	75.14	72.25	1.08	1.219	23	19	1.972	2.145	48%	52%
Untrimme	64.4	115.36	95.37	106.93	0.703	1.086	16.23	24.4	1.9	2.11	36%	64%
Trimmed	119	96	124.27	118.49	0.954	0.813	25	20	2.98	1.743	55	45
Shod	71.99	81.5	72.25	92.48	1.014	0.907	24.59	19.52	2.13	1.69	46	54
R sole pck	49	105	74.14	112.71	0.653	0.93	18	20	1.55	1.747	31	69
Hrt bar	72	65	75.14	60.69	0.959	1.075	20	19	1.722	2.162	52	48
H/Br+sl pl	67	76	66.47	78.03	1.004	0.977	23	15	2.014	1.333	46	54
Sol pckx2	68	64	69.36	75.14	0.976	0.857	22	20	1.893	1.747	50	50

Condition	Movie Averaged Frames 1-300											
	Force (KG)		Contact Area (CM ²)		Contact Pressure (KG Peak Force (KG))		Peak Con Press (KG c % Force)					
	Left	Right	Left	Right	Left	Right	Left	Right				
AS Pres	81	89	66.47	54.91	1.214	1.519	23	19	1.972	2.145	48	52
Untrimme	1.9	2.11	83.81	98.26	0.781	1.175	16	24	1.9	2.11	36	64
Trimmed	117	90	109.82	104.04	1.069	0.868	25	20	2.198	1.743	56	44
Shod	72	81	57.8	75.14	1.247	1.078	25	20	2.127	1.688	46	54
Hrt Bar	69	64	66.47	49.13	1.038	1.311	20	19	1.722	2.162	51	49
H/Br+sl pl	66	74	63.58	72.25	1.045	1.021	23	15	2.014	1.333	47	53
Sol Pk x2	67	64	66.47	69.36	1.015	0.919	22	20	1.893	1.747	51	49

This table indicates all the mean pressures of the 900 frames taken over 30 seconds of the pressure mat movie

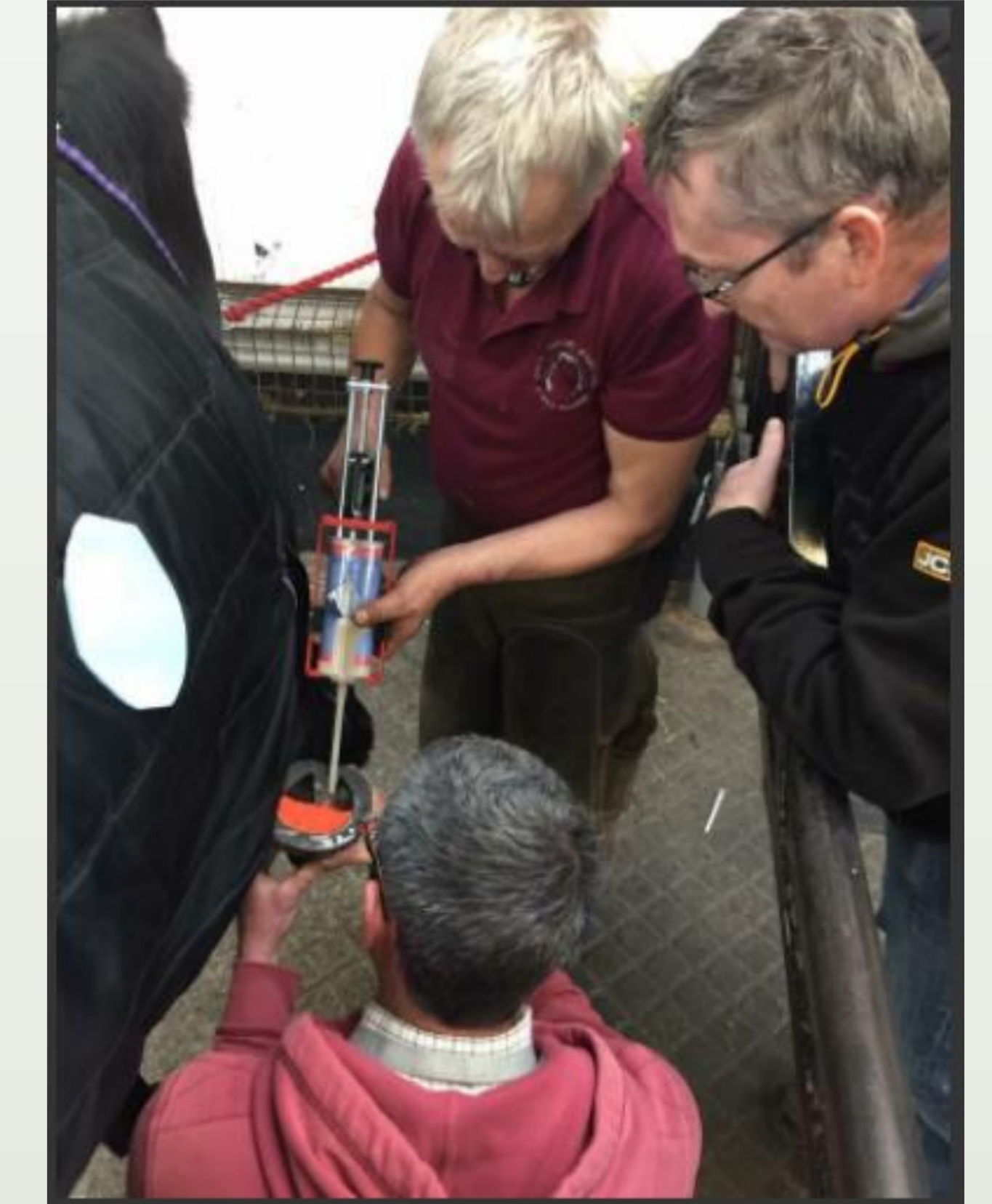


Image of procedures inserting caudal sole pack

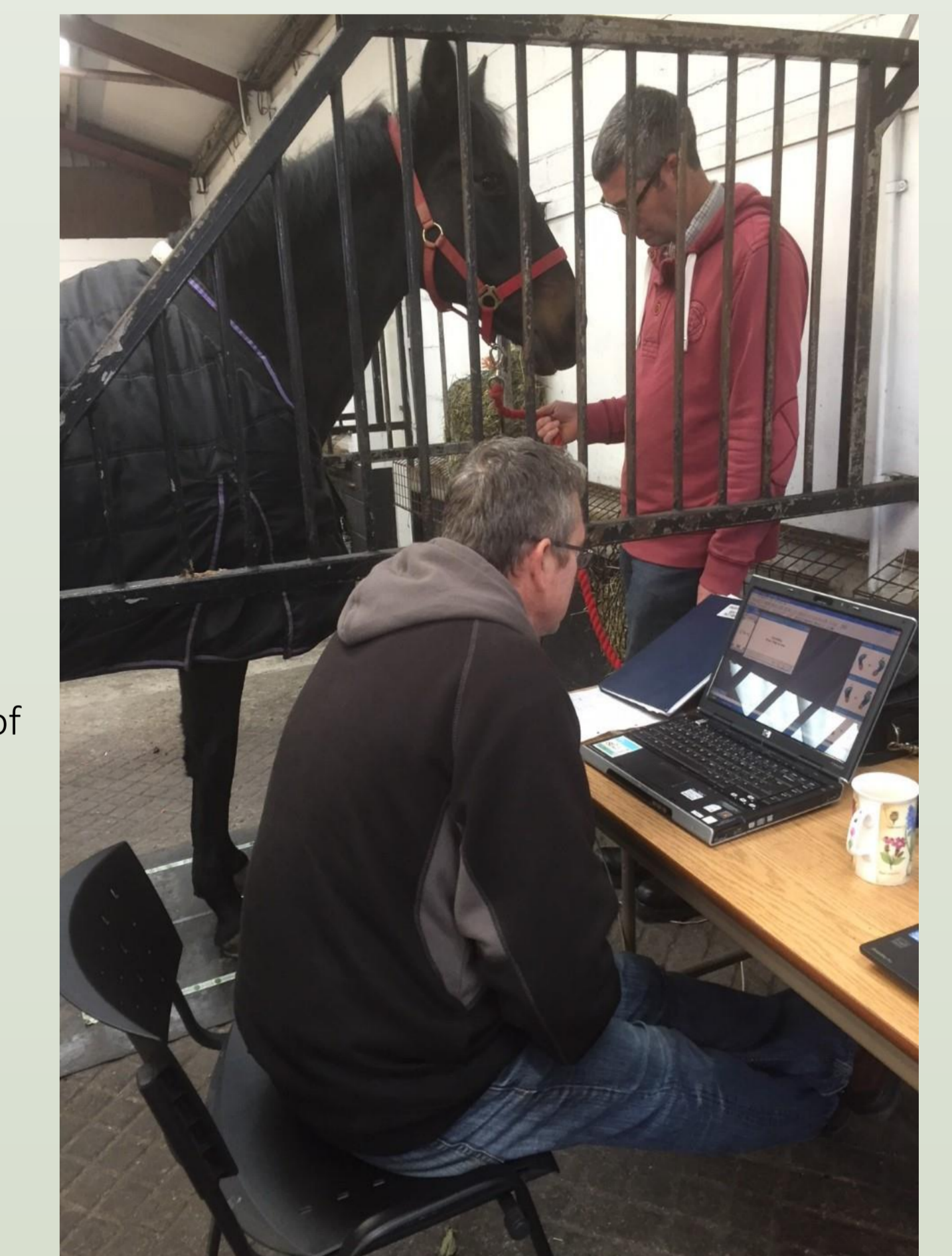


Image of horse standing on the pressure mat having the intervention on the foot measured and the data downloaded onto the laptop computer.

REFERENCES

- O'Grady, S. & Parks, A. 'Farriery Options for Acute and Chronic Laminitis', AAEP Convention proceedings (2008)
- Caldwell, M.N., Reilly, J.D. & Savoldi, M (2010). 'Quantative hoof trimming protocol for research purposes' *Forge Magazine*, April 2010

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