PACER SHOEING ACCORDING TO CONFORMATION

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Thesis for Fellowship

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ffer from 2 basic gait problems:
ring, which in this thesis includes contact between hindfeet and diagonally opposite forefeet at

tting, when the medial edge of one front foot strikes the opposite foreleg.

problems are recognised to be the result of variations in limb conformation.

tant factors influencing gait are:
/ out fore & hind.(1)
e & hind. (2)
ngth in relation to leg length (3)
rrow / wide.

se, any permutation of any number of variable conformation factors affecting gait may be found,
rable & unfavourable. The result is a confusing range of problems with a wide range of possible

surprising that many owners accept injury to their animals, and rely on boots to cover the area
risk. I think this is a less than ideal solution, since boots frequently become displaced or
during a race.(P1,2) Even when they stay in position, they do not always annull concussion
impact of a steel shod hoof moving at up to 60mph (4) When boots are removed, there is often
f oedema or haemorrhage (P3)

l practice to shoe pacers with ready made fullered concave shoes fore and hind, then wait until
shows evidence of injury before attempting remedial shoeing. Different types of fore and hind
tried in various combinations, on a largely trial and error basis.(5) While experience can
period of trial and error, as pacer shoeing represents only a small proportion of the average
workload, accumulation of experience is itself a lengthy process. Most pacers are therefore at
me extent and those with deviant conformation considerably so, especially when change of owner
change of farrier, and therefore different approach to shoeing.

that conformation determines the useful life of a horse.(6) My experience suggests that
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e of this thesis is to:
the conformation defects likely to adversely affect gait, and measure each.
information to predict type and extent of predisposed injury.
a system wherein any conformation defects in any combination, can be related to a specific
shoe, using minimum calculation.

ch a system would enable a conformation defect to be identified and remedied before a horse was
t should at least result in effective remedial shoeing at an earlier stage of working life than

pacers were measured in an attempt to fulfil 1 above.

gth from elbow to ground and stifle to ground. For these measurements, an electronic measure
ter and more acceptable to the horses than a conventional tapemeasure. Results were recorded to
t ½ inch.
ngth from wither to croup. An electronic measure placed over the wither was directed towards a
r the croup. Results were recorded to nearest ½ inch.
e & hind was measured with a hoof protractor. Accuracy +/- 1' at time of shoeing.
/ out was measured mid limb to mid toe. Results were recorded to nearest ¼ inch.
rrow / wide. This was measured limb against plumbline. Results of repeated observations showed
le discrepancy, increasing to nearly 50% after 6 attempts, presumably due to irritability,
the horses. As an alternative, distance between legs and between hooves was measured, in the
a normal range might be established, from which narrow or wide base could be distinguished. As
lumbline, I found that the range of measurements recorded increased with the number of
ns, so measurement of base was abandoned. As results suggested that casual observation would
spect, narrow or wide base was assessed according to shoe or hoof wear pattern,(8) lateral in
e, medial in wide base.

dy progressed, it became obvious that there were other factors influencing gait. Attempts to
se, drew attention to foot size, so I added to the list-
ngth and breadth, recorded to nearest ¼ inch.
rn led to the observation that foot mobility varied appreciably between animals so I added -
dial and lateral passive flexion recorded to the nearest 5'. Each hoof was placed on a rest
tached protractor so that mobility could be measured by protractor movement relative to a

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ittle practice, and with an assistant to read the protractor in hoof mobility tests, a full set
nation measurements could be recorded in less than ten minutes..

itical factor seemed to be not so much body or leg length, but the relationship between the two,
on was simplified by subtracting body length from leg length, to give a single parameter L-B.for
hind limbs.

hind legs were assessed separately for shoe selection.

Forelimb measurements

L-B	T/O	T/I	HPA	Foot L /B	Foot flexn. L/M	Foot flexn. M/L	Wear M	Wear L	Other	Fault	Shoe Actual	Shoe Predicted
0	-	-	48	5½ 5½	.	.	-	-	-	-	FC	1
1	-	-	47	.	.	.	-	-	-	-	1	1
2	-	-	60	.	.	.	-	-	-	-	1	1
2	-	-	50	4⅝ 4½	.	.	-	-	-	-	1	1
2	-	-	54	4⅝ 4⅝	10/20	20/10	-	-	-	-	1	1
3	⅛	-	50	.	.	.	-	-	-	X	3	2
3	-	-	52	5 5	.	.	-	-	-	-	1	1
4	⅛	-	52	5 5	.	.	-	L	-	XK(L)	4	4
5	-	-	55	4½ 4½	20/30	30/10	-	-	-	-	1	1
5	-	-	54	5⅜ 5½	20/30	20/10	-	-	-	K	4	4
5	⅛	-	49	5⅛ 5	.	.	-	L	-	K	4	4
5	-	⅛	52	.	.	.	-	L	1 bowleg	X (L)	4	2
5	-	-	50	.	25/25	25/25	-	-	-	X	2	1
5	-	-	45	4⅝ 4½	.	.	M	-	-	X	2	3
6	½	-	55	.	.	.	-	-	-	X	2	2
6	⅛	-	52	4⅝ 4⅝	.	.	-	-	-	X	2	2
6	-	-	45	4⅝ 4⅝	.	.	-	L	-	X	3	3
6½	-	-	48	4½ 4½	.	.	-	-	-	X**	1	1
7	-	-	51	4⅝ 4⅝	20/30	20/20	-	-	-	-	1	1
7	-	-	45	4⅝ 4⅝	20/30	20/20	-	-	-	X**	1	1
7	-	⅛	51	4⅝ 4⅝	.	.	-	-	-	-	1	1
7	-	-	51	4⅝ 4⅝	.	.	-	-	Hoof unbalanced.	X**	1	1
7	½	-	46	4½ 4½	.	.	-	-	-	X	3	3
7	-	-	56	.	.	.	-	-	-	-	1	1
7	⅛	-	52	4½ 4½	.	.	-	-	-	-	3	2
8	1½	-	50	4⅝ 4½	.	.	-	L	Low heels	X	Eggbar	4
8	⅜	-	51	4½ 4½	.	.	-	-	-	X	4	3
8	-	-	55	4⅝ 4½	.	.	-	-	-	X	2	2
9	-	-	55	4½ 4½	20/20	20/20	-	-	-	X	3	2
15	⅛	-	43	4⅝ 4⅝	.	.	-	L	-	XK	5	5

to ground minus wither to croup. Fault X= crossfiring, K= knee-hitting, XK= both.
Toe out/in. * = Horses shod elsewhere. ** = shod fuller concave.
pastern angle. = beneficial = detrimental = suspect, if other faults.
length..breadth. Shoe wear M L = medial.lateral. Shoe number.(see page II)

(L) = LEFT LEG ONLY

8	¼	–	51	4½	4½	.	.	–	–	–	X	4	3
8	–	–	55	4¾	4½	.	.	–	–	–	X	2	2
9	–	–	55	4½	4½	20/20	20/20	–	–	–	X	3	2
15	¾	–	43	4¾	4¾	.	.	–	L	–	XK	5	5

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length..breadth. Shoe wear M L = medial.lateral. Shoe number.(see page 11)
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Hindlimb measurements

	L-B	T/O	T/I	HPA	Foot L / B	Flexion L/M	Flexion M/L	Wear M	Wear L	Other	Fault	Actual	Predicted
	3	–	–	48	5¼ 5¼	.	.	–	–	–	–	A	A
	5	–	–	50	.	.	.	–	–	–	–	A	A
	5	–	–	50	.	.	.	–	–	–	–	A	A
	6	–	–	52	4½ 4½	.	.	–	–	–	–	A	A
	5	–	–	54		10/20	10/20	–	–	–	–	A	A
	7	½	–	50	5 5	.	.	–	–	–	X	B	B
	7	–	–	53	5 5	.	.	–	–	–	–	A	A
er	6	–	–	46	5 4¾	.	.	–	L	–	XK (L)	C	B
	7	–	–	56	4½ 4½	20/30	30/10	–	–	–	–	A	B
	8	–	–	52	5¼ 5¼	20/30	20/10	–	–	–	K	A	A
	8	¼	–	52	5¼ 5	.	.	–	L	–	K	A	D
re	8	–	–	58	.	.	.	–	L	–	X (L)	B	C
	10	–	–	55	.	20/20	20/20	–	–	–	X	B	C
	7	–	–	50	4½ 4½	.	.	L	–	–	X	C	A
	11	–	–	57	.	.	.	–	–	–	X	C	B
	8	¾	–	54	4¾ 4¾	.	.	–	–	–	X	B	B
	8	–	–	50	4¾ 4¾	.	.	–	L	–	X	B	B
	7½	–	–	45	4½ 4½	.	.	–	–	–	X**	A	A
	9	–	–	51	4¾ 4¾	.	.	–	–	–	–	A	A
	9	–	–	51	4¾ 4¾	.	.	–	–	–	X**	A	A
	9	–	–	52	.	.	.	–	–	–	–	A	A
	9	–	3/8	52	.	.	.	–	–	Hooves unbalanced	X**	A	A
	8	½	–	46	4½ 4½	.	.	–	–	–	X (L)	C	B
	9	–	–	55	.	.	.	–	–	–	–	A	A
	9	–	–	59	4¾ 4¾	.	.	–	–	–	X	C	B
	11	1½	–	56	4¾ 4½	.	.	–	–	–	X	C	D
	10	¾	–	52	4¾ 4½	.	.	M	–	Cow hocked	X	B	D
	9	–	–	60	4¾ 4½	.	.	–	–	–	X	B	B
	12	–	–	55	4½ 4½	20/20	20/20	–	–	–	X (L)	C	C
	15	¾	–	5	4¾ 4¾	.	.	–	L	–	XK	C	D

fle to ground minus wither to croup. Fault X= crossfiring, K= knee hitting, XK= both.
= toe out/ in. *= horses shod elsewhere. **= shod fuller concave.
of pastern angle. = beneficial = detrimental =suspect, if other faults.
oof length..breadth. L/M M/L= foot flexion. Shoe letter-(see page 11)
(L) = LEFT LEG ONLY

10	¾	–	52	4¾	4½	.	.	M	–	Cow hocked	X	B	D
9	–	–	60	4¾	4½	.	.	–	–	–	X	B	B
12	–	–	55	4½	4½	20/20	20/20	–	–	–	X (L)	C	C
15	¾	–	5	4¾	4¾	.	.	–	–	–	XK	C	D

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s of interference

.
ength. On backswing, a longer leg will obviously sweep closer to the oncoming opposite hind

ut. Weight falls on medial hoof. Foot wings inward (8), so at mid point of fore foot flight under
ere is increased chance of contact with oncoming opposite hind foot.
When low, the foot stays on the ground longer, so breakover occurs closer to the oncoming
hind foot. As more effort is need to complete breakover, the hoof is lifted higher, further
foot clearance (2).
length. A long foot obviously takes longer to complete breakover, with subsequent higher fold, as
PA. This should increase risk of crossfiring.
breadth. This should increase the medial range of any toe out effect, possibly contributing to
knee hitting. Where breakover is far off centre, a broader foot might slow action slightly.
medial flexion. A high degree will allow foot to travel further towards body midline at
, especially if there is high action because of low HPA or long feet.
or shoe wear, medial. This indicates wide base. Foot wings inward, so is likely to interfere.(18)
or shoe wear, lateral. This indicates narrow base. Foot wings outward, so is unlikely to
.(18) However, base narrow feet are carried nearer to body midline, so are unlikely to cause
ence only when opposite hind foot maximum reach coincides with the more lateral part of the
flight arc.

ength. Logically, the longer the hind legs, the greater the forward reach.
t. Feet wing inwards, especially when cow hocked to some degree.(19)
5' or more gives fast breakover (2), therefore faster return forward stride, increasing the
meeting the opposite foreleg at peak backswing.
ength. A longer foot extends range of forward reach. In some cases it might exert a beneficial
by slowing hind breakover.
readth. A broader foot obviously increases the effective range of any medial swing.
edial flexion. High degree of foot medial flexion must increase the range of effect of any limb
endency.
ear. Wide base hind legs should wing inwards, increasing interference risk.
ear. Narrow base hindlegs should wing outwards (20).

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ons of gait mechanics are, probably for simplicity's sake largely confined to horses moving in a
line. Many owners and drivers claim that interference occurs most frequently when a horse leans
rve of the track. It is recognised that a horse negotiating a bend, takes longer strides with
de hind leg, and is more likely to interefere.(9) Photos that when taking a curve, nearside
closer to body midline, and any tendency to medial breakover is exaggerated. (P4, P5) I have
ced that some horses tend to turn their heads in the opposite direction to body list. (P5),
as part of instinctive balance mechanics. It may be that this may also be an indication
ary abnormal gait mechanics. When the effect of fatigue is added, plus changes in pace rhythm
variations in track gradient, it seems possible that quite minor conformation defects could
proportionate effect. Most horses with interference problems show more than one conformation
d they seem to be mostly cumulative in effect.

s is the only factor which appently helps to offset obviously detrimental conformation. Where
are longer than body by 3" or less, the effect of big feet with lowish HPA (Croshay & Class)
high HPA (Black) seem to be cancelled out. Even short legs do not compensate for ¾" fore toe
ty).

fore and / or hind seem to guarantee interference. All horses with L-B=8" or more in front or
re behind had gait problems, though most had other conformation defects as well.

ted that short barrelled pacers are unlikely to interfere.(11) In this series, 8 horses had
29" or less, wither to croup and 5 had interference problems even in 1A shoes. The other 3
d when in fullered concave shoes. Five of the animals had disproportionately long legs. The
king was Jess, with 23" body and 38" legs.

s in this series which showed unilateral injury, all damaged their left legs. It seems likely
reflects the effect of anticlockwise tracks.

.Forelimb conformation extremes in relation to gait defect.

	No.	X	K	XK	Ok	Comment.
ody 3" or less	7	1	0	0	6	Compensated for large feet & low HPA (Croshay & Class) but not for toe out (Beauty)
ody 8" or more	5	4	0	1	0	All had other conformation defects.
	10	7	1	2	0	Beauty's short legs did not compensate for toe out.
	2	1	0	0	1	Nightmare's toed in leg also bowed. Shod elsewhere, Dell's toe in was lost because of lowering of medial hooves by 3/8 .
and less	4	3	0	1	0	The only adverse factor found in Hovis. Ginger ran clear till his fore HPA was lowered to 45 and he was shod in fullered concave shoes. Rob also had wide base. Jess had many defects.
and more.	6	3	0	0	3	Doesn't compensate for toe out (Lucky) or long legs (Eccles & Troy)
gth 5" or more.	5	0	2	1	2	Apparently reduces benefit of HPA 54' (Ralph) Effect uncertain in Equaliser & Hefin because of other defects
adth 5" or more	5	0	2	1	2	Apparently of no significance in short legged horses, (Croshay Tuff)
row.	6	3	1	2	0	All had other detrimental factors, suggesting that expected wing out does not compensate for bow leg, toe out or long legs.
e	1	1	0	0	0	Wing in might be responsible for X in Rob, though he also has low HPA
ial flexion 30'	3	0	1	0	2	Suspect detrimental effect in Ralph, but insufficient data.

imental statistics
ficial statistics.

- Suspect detrimental effect in Ralph, but insufficient data.

imental statistics
ficial statistics.

Hindlimb conformation extremes

	No	X	K	XK	Ok	
ody 5" or less	4	0	0	0	4	Despite ¼" toe in (Black) & big feet (Croshay)
ody 10" or more	6	5	0	1	0	In Tudor, long hind legs were the only abnormality found. In Troy, long fore & hind legs were the only abnormalities.
	8	5	1	1	1	No adverse effect in short legged horse. (Black)
	1	1	0	0	0	Induced by hoof trimming (Dell) Crossfired in fullered concave shoes. Restoring hoof balance & 1A shoes corrected.
and less	4	2	0	2	0	Billy showed no other defect, but crossfired only in fullered concave shoes, which would exaggerate effect. All other horses had other defects.
and more	6	5	0	0	1	Sasha Ok despite high medial hoof flexion. Fore HPA 55' may compensate. High hind HPA probably adds to Nightmare's problem. All other horses show other defects.
ngth 5" or more	5	1	0	0	4	No effect in Croshay, Tuff because of short legs.
eadth 5" or more	4	0	0	0	4	
rrow	5	2	1	2	0	All had other detrimental factors.
de	1	1	0	0	0	Suegar had also high HPA.
dl. flexion 30'	2	0	0	0	2	

rimental statistics
eficial statistics.

dl. flexion 30' 2 0 0 0 2

rimental statistics
eficial statistics.

cal beneficial and detrimental ranges of L-B

al range of L-B of up to 3" takes into account the observation that (according to this small long, wide feet seem likely to predispose to knee hitting. In Croshay, 5 x 5" feet caused no even with accompanying low HPA, presumably because of L-B=0. Tuff had similar sized feet and did erfere. His only apparent compensating factor was L-B=3".
ith feet well over the proposed upper normal limit of $4\frac{3}{4}$ x $4\frac{3}{4}$, occasionally knee hit, suggesting 5" was outside the protective range.

r, the only horse with 5 x 5" feet and L-B between Tuff and Ralph, had other complications in toe ow base. The series examined is too small to show whether Equaliser's L-B=4" would have made him the absence of toe out and narrow base.

legs, selection of upper beneficial limit of L-B=5 also depends heavily on Equaliser's crossfiring ly in view of the fact that his hind HPA of 46' might have been expected to reduce crossfire risk.

tal range for forelegs of L-B=8" plus, allows for Milo's problem free L-B=7, even with a high fore les with L-B=8 crossfired; no other cause showed up in his foreleg statistics.

L-B=10 plus on the basis of Milo L-B=9 problem free, while Tudor L-B=10, crossfired.

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xion - discussion

ot possible from the few horses studied, to prove that hoof flexion influenced gait in any way. ent of other working horses suggested that reduced range of mobility was commoner in older animals oung horses known to have had injury to the DIP region, though results were not clear cut. In ncreased medial hoof flexion might contribute to knee hitting risk, but as only Ralph came into egory while Sasha had high medial flexion in both front feet, no conclusion is possible. However, of the comparative simplicity and reproducibility of this feature, the wide range of results must e significance. I think further study is justified.

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oes in current use

11 ½ x ¼".)
stamped, with clip.
stamped with rolled toe - speeds breakover, shortens stride, gives higher fold.(11)
" with square toe - further speeds, breakover and tends to move breakover point medially.
" with medial offset square toe. (Griffin shoe) Detail page 12.
ffin shoe with added medial grab. (P6)

all following hind pacer shoes, medial toe quarter is squared, to remove some striking edge.

with lateral donkey heel & 3/8 x ¼ medial branch. Donkey heel widens gait.(14)
A plus lateral heel wedge -further widens gait - slows breakover.
A plus lateral calk trailer- raises lateral hoof so turns foot laterally.
A plus lateral calk & toe grab - reduces hind foot reach.
fullered concave. } Equivalent to C+D, on grass tracks.
E with lateral calk. }

ary treatment of hoof.

fore hoof laterally by up to 3/16 . (3/8 causes ligament strain followed by calcification in young
s, medial corns in older animals. (15) This gives mild correction of toe out (16), by moving
over point medially.
hind hoof medially by 3/16 to give mild toe out effect, except in hind feet naturally toed out.
t HPA fore & hind, and hoof length to suit individual animal.

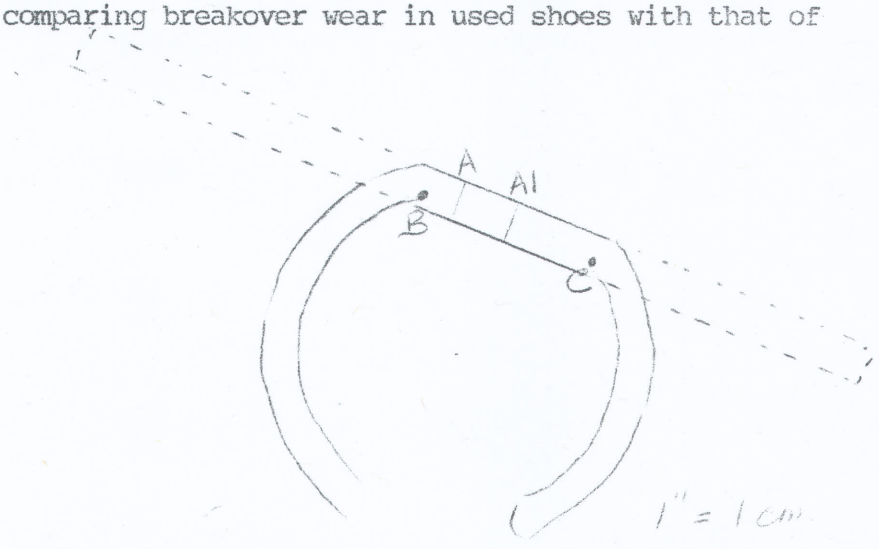
in Shoe

n offset square toed front shoe. It differs from existing square toed shoes in that it is made
e for each individual horse, according to degree of toe out and foot breadth.
ght section internal measurement is half the foot width. The mid point of the straight section
s the medial branch of the shoe (viewed from above), by the extent of toe out, or foot breadth
of 4¾", whichever is greater.

example, a 5 x foot with ¾" toe out, calculation is:
length 5 + 5 + 1" of ½ x ¼.
centre of strip =A
this case toe out exceeds hoof breadth, measure ¾" towards medial branch of shoe. Chalk A1.
er straight edge is half hoof breadth, measure 1¼" to right and left of A1. Punch B, C on inner
f strip.
resents the extent of the inner straight edge. B & C are the first & second bending points in
haping.

is effective in knee hitters, and as a front shoe in severe crossfirers.
has performed better than speedy cutting shoes, bar shoes, medial fuller & G shoes.

the shortened toe speeds breakover, therefore RAISES foot action, while the offset toe
es breakover, and this is borne out by comparing breakover wear in used shoes with that of
shoes on the same horse.



lection based on conformation defects

-B=3" or less, ignore all conformation deviation except toe out.

3" or more	counts 1 defect.
out ¼" or more	1
45' or less. (If other faults suspect 46')	1
(not hoof) length 5" or more	½
breadth 5" or more	½
wide (medial shoe wear)	1
narrow (lateral shoe wear)	1

B=5" or less, disregard all conformation deviations except toe out.

0" or more	1 defect.
ut ¼" or more	1
5' or more	1
length 5" or more	½
breadth 5" or more	½
wide (Medial shoe wear)	1
narrow (Lateral shoe wear)	1

ion -fore.

rse with no recognised conformation defects, fit shoe 1.
horse with long, broad forefeet (and L-B= 3" plus), suspect knee hitting conformation, fit 4.
rse with 1 defect, shoe 2, 2 defects shoe 3 etc.

ion - hind

rse with no conformation defect, shoe A.
and/or broad hindfeet count as ½ defect each, only if other defects are found.
on basis of 1 defect -shoe B, 2 defects C etc.,

rse with 1 defect, shoe 2, 2 defects shoe 3 etc.

ion - hind

rse with no conformation defect, shoe A.
and/or broad hindfeet count as ½ defect each, only if other defects are found.
on basis of 1 defect -shoe B, 2 defects C etc.,

ON

for pacer shoe selection based on a series of simple conformation statistics is proposed.
er of pacers investigated is small, so it is likely that in the light of wider experience in
he system, further modification of the system will be inevitable.

ethod outlined was generally adopted, it would lead to earlier and more specific remedial
stimulate investigation of conformation defects and lead to deeper understanding of gait
s. It would be of advantage to horses, farriers and ultimately owners, if a record of
ion statistics accompanied horses when they changed owners. As familarity with measurable
ion defects increased, it is likely that more selective breeding would result.

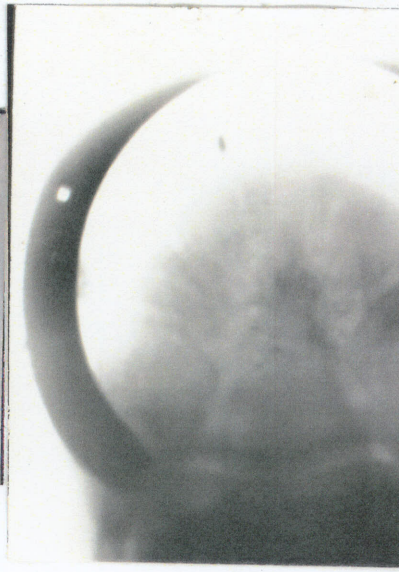
KNEE KICKER

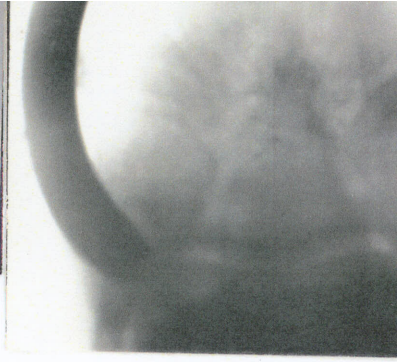
PICTURE 1 & 2

3(i)

3(ii)

3(iii)





URE 4

5(ii)

PICTURE 6

5(ii)

PICTURE 6

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