



Golf Swing Biomechanical Analysis



**PJ Worden
Swing 5 with Driver
6-9-09
Analysis by Phil Cheetham**

Summary

- The main issue appears to be stability. He had problems with the balance test, the pelvic rotation test also showed stability issues and he was unable to perform the pelvic tilt test. This appears in the swing in terms of 3D stability issues which inhibit the efficiency of his downswing kinematic sequence, causing arms to peak before pelvis and thorax (ribcage). He hangs back significantly at impact and follow-through. He does not transfer weight to his lead leg. He also has a tendency to thrust toward the ball.
- This lack of lower stability leads to excessive arms (shoulders) as one of his main power sources; including an early release of the club (casting) and a significant bend of the lead arm around impact (chicken winging). These mentioned issues all lead to significant loss of power and hence; distance.

Take Home Message

- Improve balance and stability with appropriate exercises. This will make it comfortable to support weight on lead leg at impact and finish. Then learn to turn body rapidly (hips then ribcage), leaving arms and club lagging during downswing, also actively transferring weight to lead leg.
- We can recommend a trainer and can if necessary supply some example exercises. A follow up analysis is recommended after 6 to 8 weeks of training.

Details

Tempo

- Slow tempo and long back swing, he needs to be quicker and more dynamic in backswing
- Tempo Trainer would help (we have one available at AMM)

Kinematic Sequence

Transition

- Order is almost okay,
- Timing not so good, club is late after body turn around, i.e. there is excessive lag due to bent lead arm
- Bent lead arm at top is followed by early release of the elbow and casting at wrist (leads to lack of power)

Downswing

- Peaking Order is Arm, Pelvis, Thorax+Club; efficient order is Pelvis, Thorax (i.e. upper body), Arm, Club
- Peak timing is very late, but arms peak first (throwing club and arms).
- Peak speeds are very low (lack of power)
- Very low accels/decels (virtually no pelvis decel, no thorax decel)

Contribution of Speed by Joint

- Quite a bit from legs and shoulder
- Minimal from wrist (due to casting)

Trunk Dynamic Stability

- Stability issues here.
- Hanging back, falls back after impact (weight increases on trailing leg just before impact), due to poor balance ability
- Unstable pelvis and thorax thrust – excessively forward (towards ball) at each point (top, impact and finish)
- Pelvis and thorax low (down) at impact due to hanging back
- Lack of thorax trail side bend at impact (flat shoulders, typical of casting and early release)

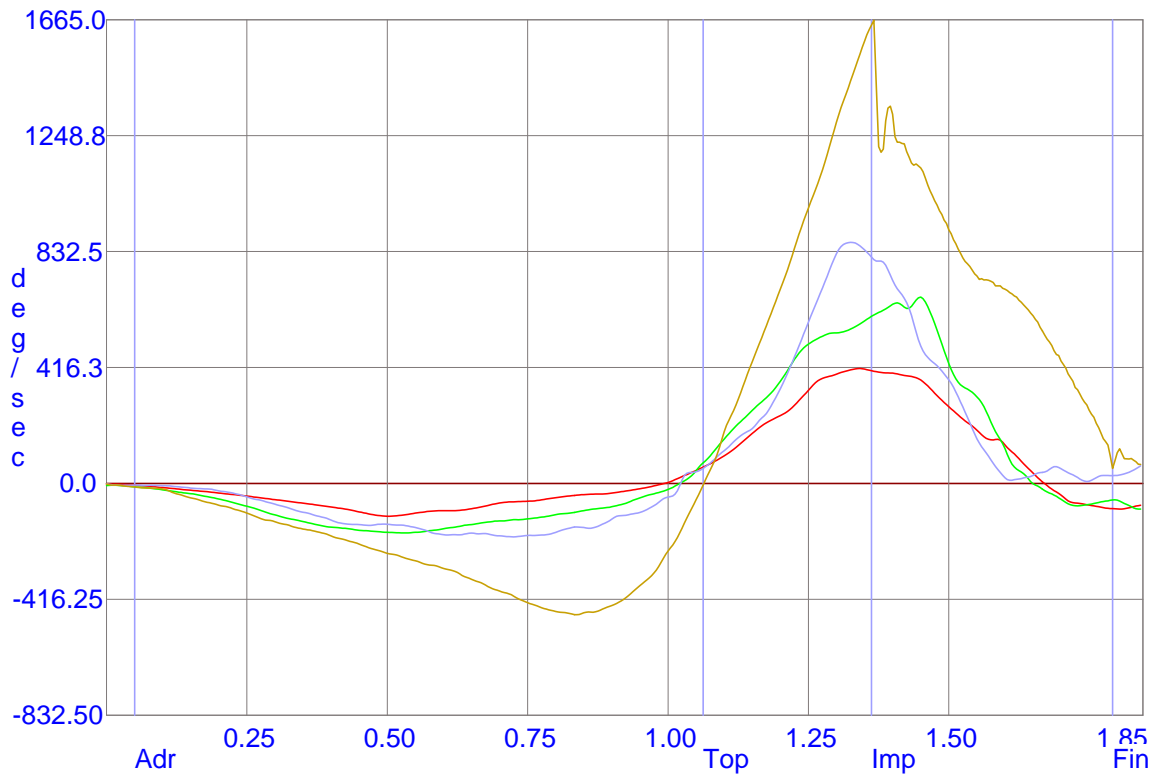
Physical Screen

- Had a stroke and heart attack several years ago
- Unable to perform pelvic tilt motion
- Deep squat very limited but ankle range ok; therefore pelvis and thorax
- Toe Touch limited bilaterally
- Poor balance, couldn't balance even with eyes open
- Pelvic Rotation – stability was limited

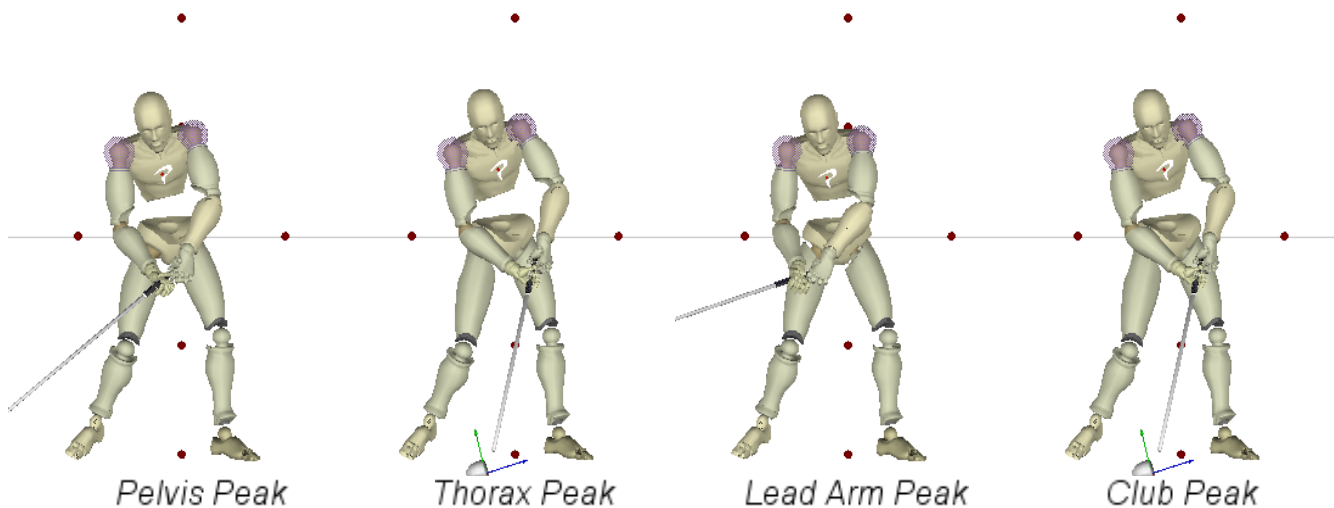
Please see the following report for more details.

Email me at phil@amm3d.com if you have any questions

Kinematic Sequence



Positions at Peak Segmental Angular Speeds

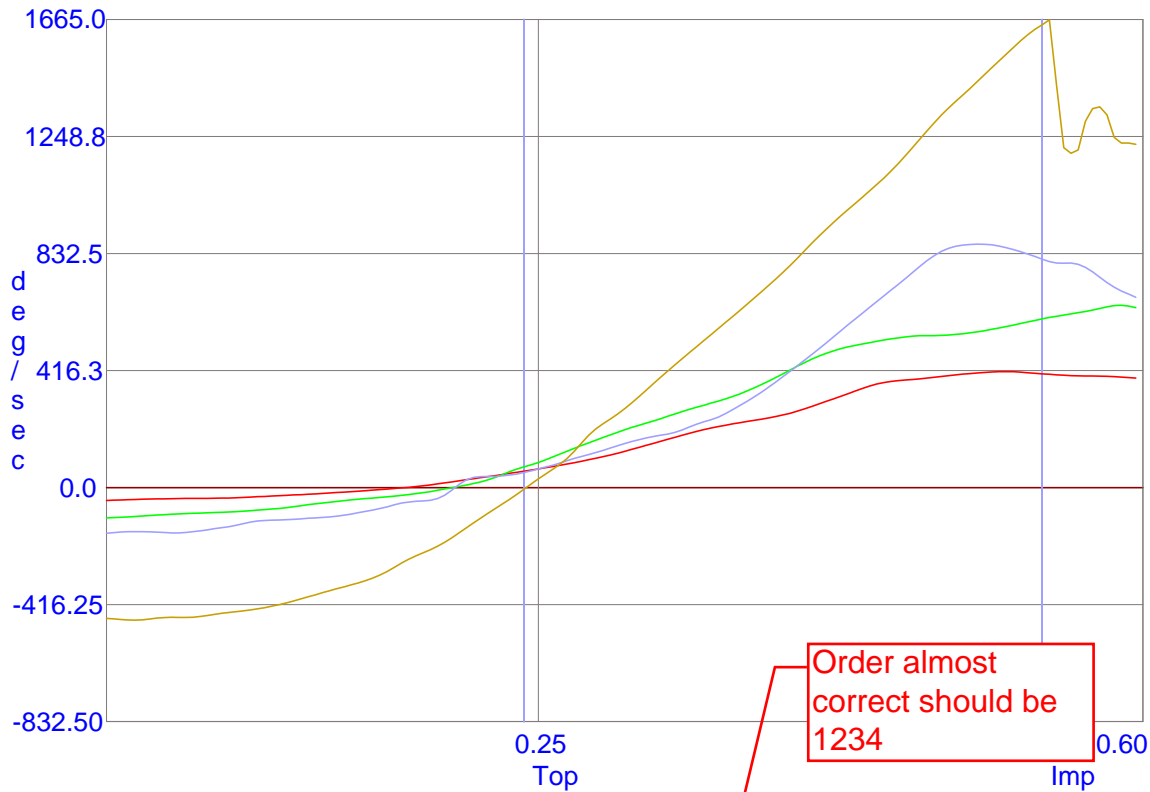


		Backswing		Downswing		Follow Through	
Tempo	ms	1013	736 to 958	300	233 to 296	429	525 to 825

Slow backswing

Transition Sequence

Angular Velocity: **Pelvis** **Thorax** **Arm** **Club**



Transition Parameters

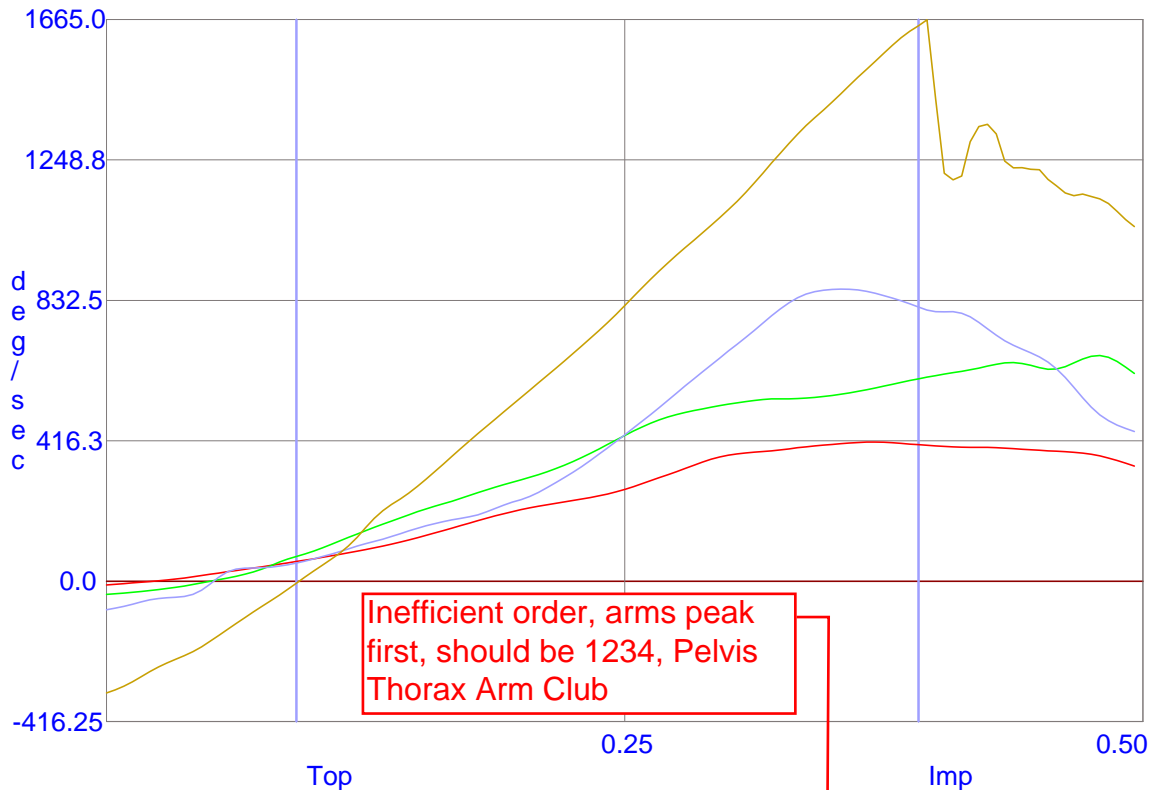
		Pelvis		Thorax		Arm		Club	
Transition Order	order	1		2		2		3	
Transition to Top	ms	71	17 to 94	42	4 to 58	42	-6 to 30	0	0 to 0
Transition to Peak	ms	350	187 to 263	342	185 to 264	304	170 to 237	300	232 to 294
Transition to Impact	ms	371	286 to 355	342	259 to 333	342	244 to 308	300	233 to 296
Transition Acceleration	d/s/s	626	757 to 1682	1272	1026 to 2340	1903	1893 to 3958	4586	2724 to 5730

Segmental Interactions

		Pelvis-Thorax		Thorax-Arm		Arm-Club	
Time Between Transitions	ms	29	-6 to 55	0	-1 to 40	42	-6 to 30

Downswing Sequence

Angular Velocity: **Pelvis** **Thorax** **Arm** **Club**



Sequence Parameters

		Pelvis		Thorax		Arm		Club	
Peak Order	order	2		3		1		3	
Peak Timing Pre-Impact	ms	21	77 to 113	0	54 to 89	38	62 to 81	0	-1 to 5
Peak Speed	d/s	413	415 to 522	600	629 to 764	866	888 to 1038	1646	2108 to 2306
% of Max	%	25	18 to 23	36	28 to 34	53	40 to 46	100	100 to 100
Acceleration	d/s/s	1182	1717 to 2595	1757	2579 to 3856	2836	4190 to 5942	5508	7474 to 9734
Deceleration	d/s/s	385	1223 to 2734	0	1508 to 3889	1422	5764 to 8356	5236	7821 to 9375

Low speeds and accelerations

Segmental Interactions

		Pelvis-Thorax		Thorax-Arm		Arm-Club	
Time Between Peaks	ms	21	5 to 43	-38	-18 to 17	38	61 to 79
Angular Speed Gain	d/s	187	184 to 272	266	211 to 321	781	1160 to 1327
Gain Factor	ratio	1.5	1.4 to 1.6	1.4	1.3 to 1.5	1.9	2.2 to 2.4

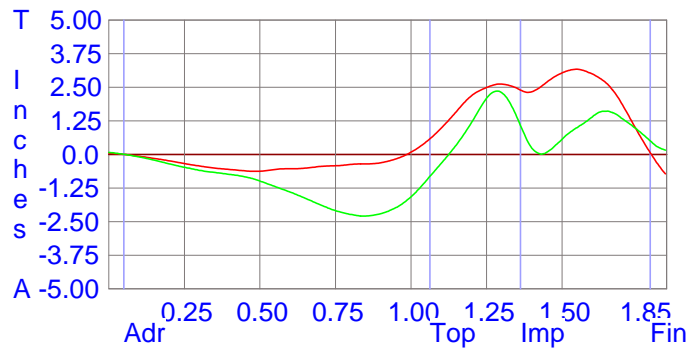
Contribution by Joint

		Legs		Core		Shoulder		Wrist	
% Contribution	%	25	18 to 23	11	8 to 12	16	9 to 14	47	53 to 59

Low due to casting of the club

Trunk Dynamic Stability

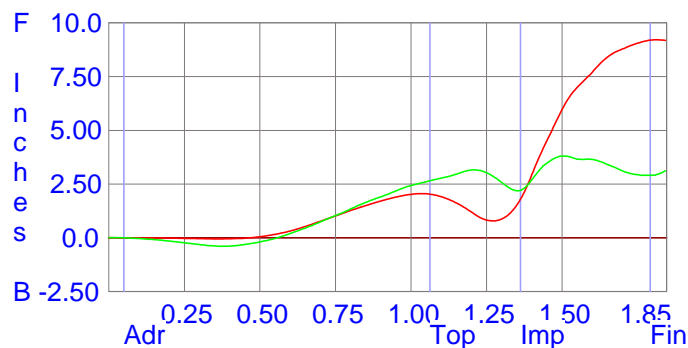
Sway - Pelvis and Thorax



(Inches)	Adr		Top		Imp		Fin	
Pelvis	0.0 T	0.0A to 0.0A	0.6 T	1.0A to 1.4T	2.4 T	2.6T to 5.6T	0.1 T	5.6T to 9.4T
Thorax	0.0 T	0.0A to 0.0A	0.8 A	1.6A to 0.8T	1.1 T	1.9A to 1.1T	0.5 T	3.2T to 8.6T

Hanging back at impact

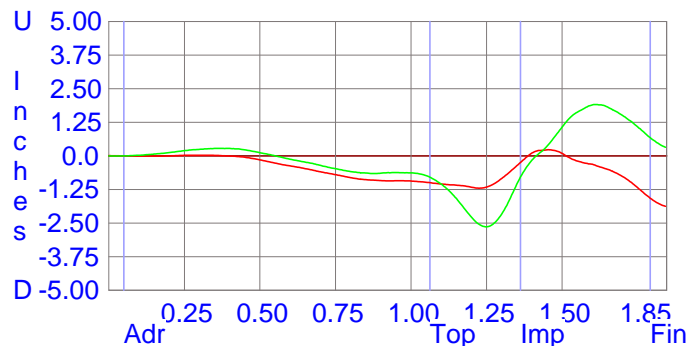
Thrust - Pelvis and Thorax



Falls back onto back leg after impact

(Inches)	Adr		Top		Imp		Fin	
Pelvis	-0.0 B	0.0B to 0.0B	2.0 F	0.3F to 2.1F	1.8 F	0.3B to 1.9F	9.2 F	1.6F to 4.2F
Thorax	0.0 F	0.0B to 0.0B	2.7 F	0.3F to 2.5F	2.2 F	2.5B to 0.1F	2.9 F	0.7B to 1.9F

Lift - Pelvis and Thorax



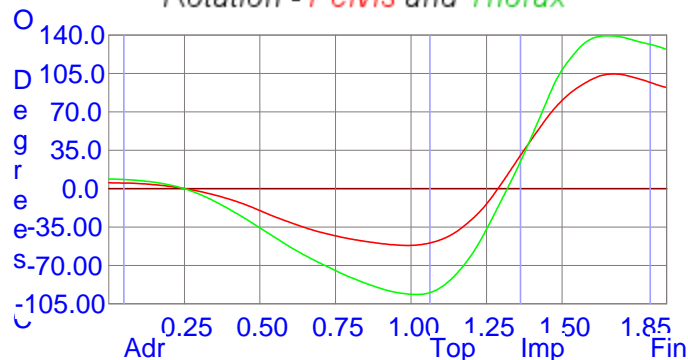
Leaning forward towards the ball the whole time; these numbers are all high

(Inches)	Adr		Top		Imp		Fin	
Pelvis	-0.0 D	0.0D to 0.0D	1.0 D	1.5D to 0.3D	0.2 D	0.3D to 1.3U	1.6 D	0.2U to 1.2U
Thorax	0.0 D	0.0D to 0.0D	0.8 D	1.7D to 0.3U	0.8 D	0.7D to 1.5U	0.7 U	1.6U to 3.8U

Low numbers, body is dropped down and doesn't raise

Trunk Dynamic Stability

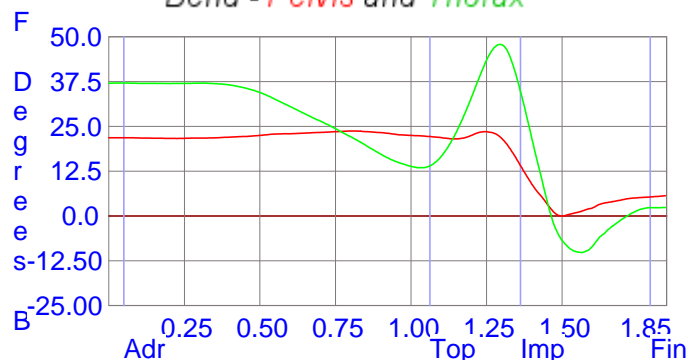
Rotation - Pelvis and Thorax



(Deg)	Adr		Top		Imp		Fin	
Pelvis	5.2 O	2.8C to 6.0O	49.4 C	55.9C to 39.9C	30.6 O	29.5O to 48.3O	96.9 O	97.1O to 115.3O
Thorax	8.4 O	7.0O to 14.6O	94.6 C	97.8C to 83.4C	25.0 O	20.5O to 36.7O	131.5 O	138.8O to 159.4O

OK rotations at these points

Bend - Pelvis and Thorax

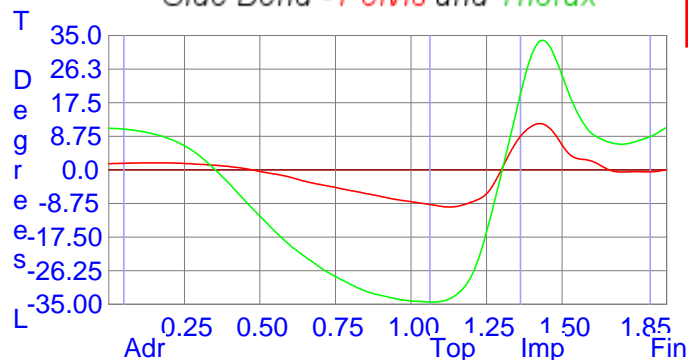


(Deg)	Adr		Top		Imp		Fin	
Pelvis	21.9 F	13.4F to 26.4F	22.2 F	10.5F to 23.3F	14.0 F	1.5B to 11.1F	5.3 F	0.8F to 14.2F
Thorax	37.1 F	28.4F to 40.2F	14.0 F	4.8B to 7.8F	34.6 F	18.5F to 28.9F	2.4 F	36.4B to 24.2B

Not rotated enough at finish

Excessive; shows loss of balance at impact

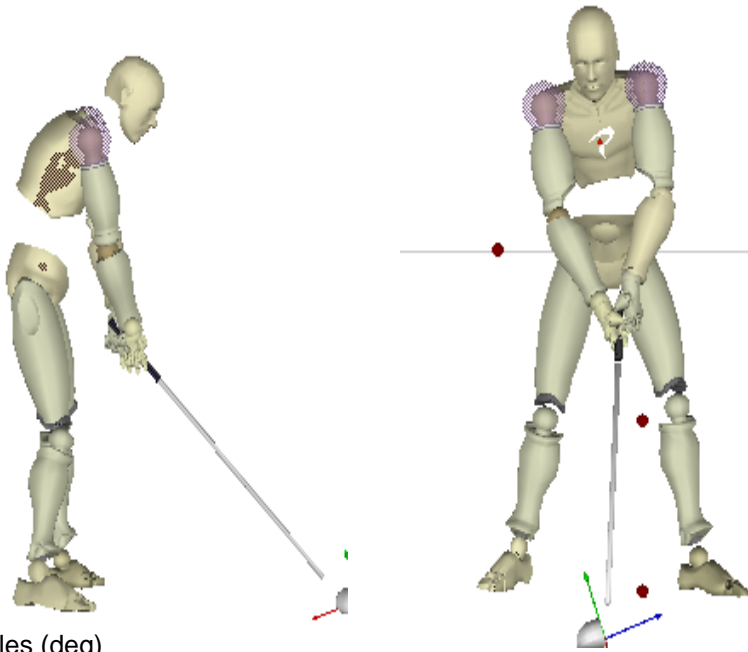
Side Bend - Pelvis and Thorax



(Deg)	Adr		Top		Imp		Fin	
Pelvis	1.7 T	3.4L to 3.2T	9.0 L	14.1L to 6.3L	8.8 T	6.0T to 12.6T	0.5 L	2.4L to 5.0T
Thorax	10.6 T	11.0T to 17.4T	34.4 L	40.1L to 28.1L	19.8 T	26.7T to 36.7T	8.7 T	0.3T to 15.5T

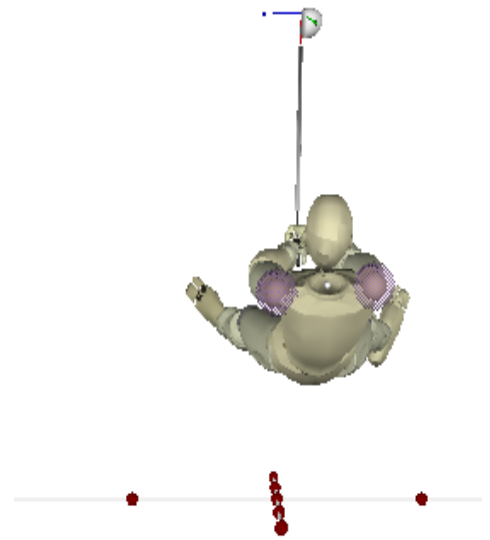
Low, side bend of upper body; typical of casting

Position At Address



Angles (deg)

	Pelvis		Thorax	
Rotation	5 O	2C to 6O	8 O	7O to 14O
Bend	22 F	13F to 26F	37 F	28F to 40F
Side Bend	2 T	3L to 3T	11 T	11T to 17T

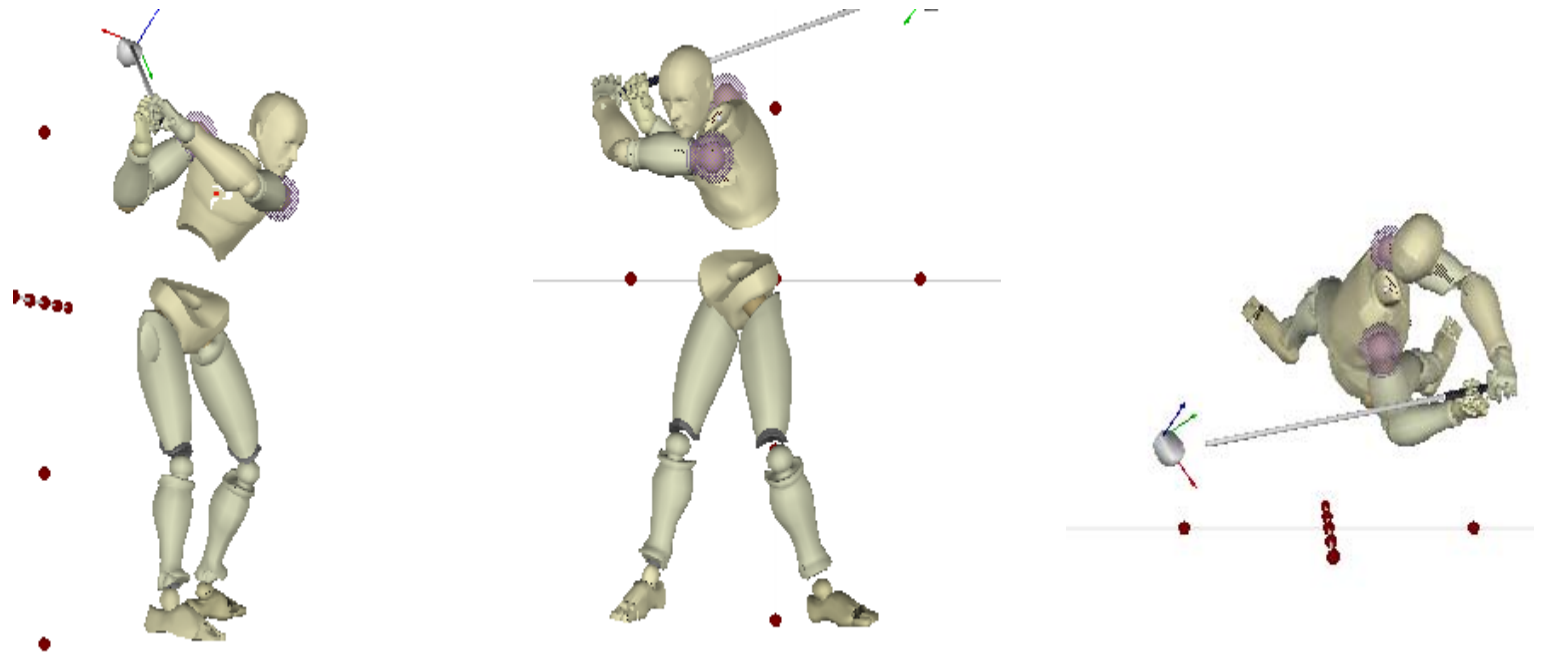


Angles (deg)

	Spine	
Rotation	3 O	3O to 15O
Flexion-Extension	15 F	6F to 21F
Side Bend	9 T	10T to 18T

Pretty good
posture values at
Address

Position At Top



Angles (deg)

	Pelvis		Thorax	
Rotation	49 C	55C to 39C	95 C	97C to 83C
Bend	22 F	10F to 23F	14 F	4B to 7F
Side Bend	9 L	14L to 6L	34 L	40L to 28L

Angles (deg)

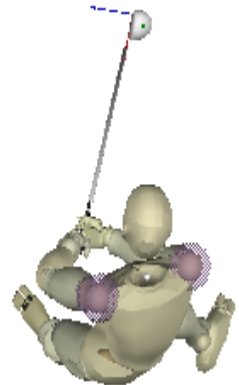
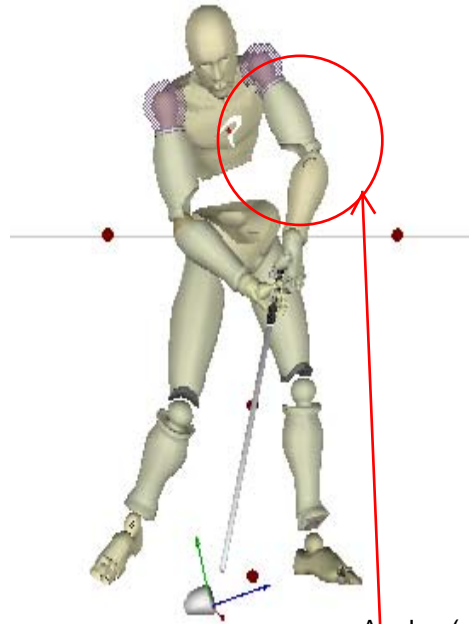
	Spine	
Rotation	49 C	50C to 37C
Flexion-Extension	8 B	23B to 7B
Side Bend	25 L	30L to 17L

Displacements (inches)

	Pelvis		Thorax	
Sway	0.6 T	1.0A to 1.4T	0.8 A	1.6A to 0.8T
Thrust	2.0 F	0.3F to 2.1F	2.7 F	0.3F to 2.5F
Lift	1.0 D	1.5D to 0.3D	0.8 D	1.7D to 0.3U

Good top of
backswing posture
numbers overall.
May be a little too
much forward bend
and thrust of thorax

Position At Impact



Angles (deg)

	Pelvis		Thorax	
Rotation	31 O	29O to 48O	25 O	20O to 36O
Bend	14 F	1B to 11F	35 F	18F to 28F
Side Bend	9 T	6T to 12T	20 T	26T to 36T

Displacements (inches)

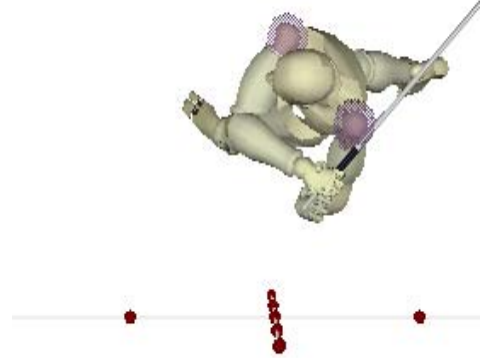
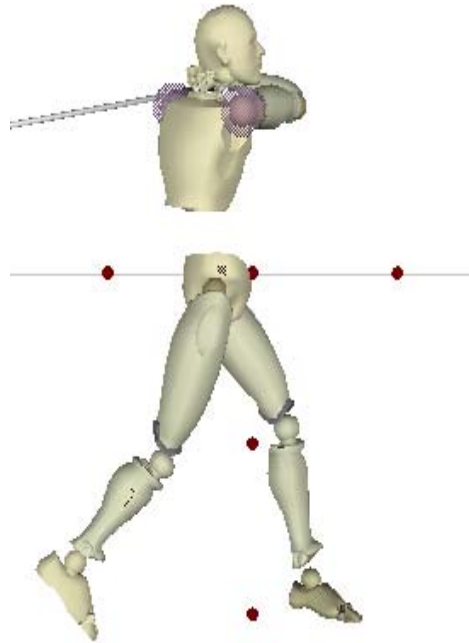
	Pelvis		Thorax	
Sway	2.4 T	2.6T to 5.6T	1.1 T	1.9A to 1.1T
Thrust	1.8 F	0.3B to 1.9F	2.2 F	2.5B to 0.1F
Lift	0.2 D	0.3D to 1.3U	0.8 D	0.7D to 1.5U

Angles (deg)

	Spine	
Rotation	4 C	19C to 6C
Flexion-Extension	21 F	11F to 26F
Side Bend	11 T	17T to 27T

Notice bent lead arm (Chicken Winging).
Shoulders should be more open and more
right side bent

Position At Finish



Angles (deg)

	Pelvis		Thorax	
Rotation	97 O	97O to 115O	131 O	138O to 159O
Bend	5 F	0B to 14F	2 F	36B to 24B
Side Bend	1 L	2L to 5T	9 T	0L to 15T

Angles (deg)

	Spine	
Rotation	35 O	28O to 44O
Flexion-Extension	3 B	46B to 29B
Side Bend	9 T	1L to 14T

Displacements (inches)

	Pelvis		Thorax	
Sway	0.1 T	5.6T to 9.4T	0.5 T	3.2T to 8.6T
Thrust	9.2 F	1.6F to 4.2F	2.9 F	0.7B to 1.9F
Lift	1.6 D	0.2U to 1.2U	0.7 U	1.6U to 3.8U

Hanging way back

Thrusting towards tee

Still down low

All numbers are pink due to loss of balance and lack of weight transfer to the lead leg