What Differentiates a Good Golfer from a Bad Golfer?

Musculoskeletal Factors

Transverse Plane Flexibility

1. Hip Internal and External Rotation Flexibility
   Proficient Golfers have 15° more hip internal rotation motion than Average Golfers
   Proficient golfers have 16° more hip external rotation motion than Average Golfers

2. Trunk Rotation Flexibility
   Proficient Golfers have 20° more seated trunk rotation motion than Average Golfers
   Proficient Golfers have 33° more standing trunk rotation motion than Average Golfers

3. Shoulder Internal and External Rotation Flexibility
   Proficient Golfers have 9° more shoulder internal rotation motion than Average Golfers
   Proficient Golfers have 8° more shoulder external rotation motion than Average Golfers

Biomechanical Factors

X-Factor – pelvis-trunk dissociation

	X-Factor		
	At Top of Backswing	Peak	At Ball Impact
Proficient Golfers	56±6°	62±5°	***36±5°***
Average Golfers	54±11°	57±10°	27±6°
Unskilled Golfers	***41±6°***	***46±6°***	21±6°

Proficient golfers maintain a large separation between the trunk and the pelvis all the way to ball impact indicating efficient use of elastic energy in the trunk. Unskilled golfers do not effectively separate their pelvis from their trunk at the top of the backswing and at the initiation of the downswing.

Kinematic Sequence – pelvis trunk energy transfer

	Rotational Velocity		
	Pelvis	Trunk	Lead Arm
Proficient Golfers	***526±83***	604±88	1167±107
Average Golfers	474±92	573±69	1161±263
Unskilled Golfers	413±71	538±92	1010±210

Proficient golfers are able to generate higher pelvis rotation velocities.

	Average Acceleration ($°\cdot s^{-2}$)		Average Deceleration ($°\cdot s^{-2}$)	
	Pelvis	Trunk	Pelvis	Trunk
Proficient Golfers	***2560±760***	***3017±683***	***3139±1489***	***3214±1653***
Average Golfers	2160±676	2748±722	2247±1435	1752±1201
Unskilled Golfers	1757±589	2200±731	1294±845	998±923

Proficient golfers achieve greater acceleration of the pelvis and trunk at the initiation of the downswing and greater deceleration of the trunk and pelvis prior to ball impact. This is indicative of an effective whip with trunk deceleration being the key metric.

Ground Reaction Forces – weight shift

	Lead Leg Ground Reaction Force (% body weight)			
	Top of Backswing	Peak	Impact	Unweighting
Proficient Golfers	33.0±10.8%	139.5±19.6%	63.3±35.6%	***76.2±36.5%***
Average Golfers	30.3±10.8%	136.1±24.2%	71.4±29.8%	64.7±30.1%
Unskilled Golfers	36.8±16.0%	120.1±20.7%	90.8±16.6%	***28.8±21.9%***

Shifting the weight from the back leg to the front leg at the initiation of the downswing occurs with all golfers but proficient golfers rapidly load the front foot and most importantly off load just prior to ball impact. It is this unweighting that best discriminates proficient golfers from unskilled golfers.