Lower Quarter of Golf Swing

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Objectives

By the end of this presentation, the audience will…

1. Understand current research on the possible impact of the pelvis/hip on injuries to golfers.
2. Describe and analyze the different phases in a golf swing and the major muscles that contribute to those movements.

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Clinical Relevance

- Golf
  - According to the National Golf Foundation, 41.1 million people (Age 6+) played golf
    - 25.6 million played on a golf course
    - 15.5 million participated in off-course golf activities
    - 3.3 million played golf for the first time in 2022.
- Other sports that incorporate swinging mechanics
  - Baseball
  - Tennis / Pickleball
  - Hockey
  - Cricket

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What Makes a Golf Swing?

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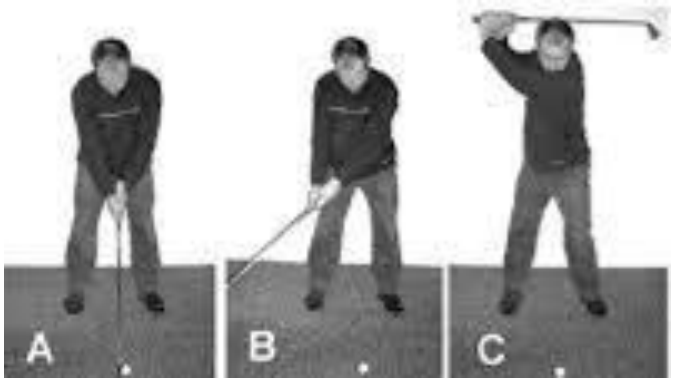
Backswing

- Positions golfer in optimum position to initiate the downswing.
- Weight shifted toward trail leg
- EMG studies indicate majority of activity occur at the lower extremities and trunk.
- Muscles involved
  - Front Leg
    - Erector spinae (26%)
    - Abdominal oblique (24%)
  - Back Leg
    - Semimembranosus (28%)
    - Long head of biceps femoris (27%)



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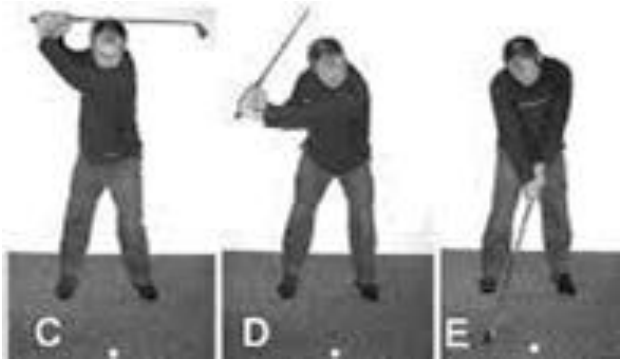
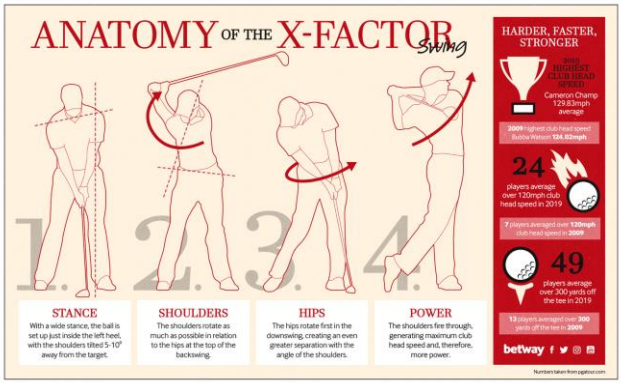
Downswing

- Phase in which most golf injuries occur (2x compared to backswing)
- X-Factor - Hip to Shoulder Separation
- Forward/Downswing (top of the swing to horizontal position of club
  - Muscle involved
    - Front Leg
      - Vastus lateralis (88%)
      - Adductor magnus (63%)
    - Back Leg
      - Gluteus maximus (upper 100% and lower 98%)
      - Biceps femoris (78%)
- Acceleration (Horizontal position of club to impact)
  - Muscles Involved
    - Front Leg
      - Biceps femoris (83%)
      - Upper & lower gluteus maximus and vastus lateralis (58%)
    - Back Leg
      - Gluteus medius (51%)





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Follow Through

- Deceleration of swing
- Comprises of about 25% of injuries from golf swings
- Early Follow Through (impact to horizontal position of club)
  - Front Leg
    - Long Head of biceps femoris (79%)
    - Vastus lateralis (59%)
  - Back Leg
    - Gluteus medius (59%)
    - Abdominal oblique (51%)
- Late Follow Through (horizontal position of club to completion)
  - Front Leg
    - Semimembranosus and vastus lateralis (42%)
    - Adductor magnus (35%)
  - Back Leg
    - Vastus lateralis (40%)
    - Gluteus medius (22%)

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Research Says, Hips Don't Lie

- Vad et al. 2004
  - Decreased lumbar extension, lead hip IR, and lead FABER distance correlated to history of low back pain
- Murray et al. 2009
  - Among amateur golfers who suffer LBP, LBP group had significantly reduced lead hip passive and active IR compared to controls.

	Symptomatic (n = 14)	Asymptomatic (n = 28)
Finger-to-floor distance (cm) (P = .09)	14 ± 1.4	11 ± 1.3
Lumbar extension (degrees)	15.7 ± 1.3*	24.3 ± 1.4
FABERE's distance (cm) (P = .08)		
Lead	16.8 ± 1.3*	9.3 ± 1.5
Nonlead	6.7 ± 1.3	6.8 ± 1.2
Hip internal rotation (degrees) (P = .11)		
Lead	11.8 ± 1.2*	16.9 ± 1.3
Nonlead	19.9 ± 1.7	19.7 ± 1.6

Data presented as mean ± SD. PGA, Professional Golfers Association; *P < .05, significant.

Vad et al. 2004

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Professional vs. Amateur

- Sell et al. 2007
  - Compared 257 right-handed male golfers in different proficiency levels based on handicap index (< 0 / 1-9 / 10-20)
  - Golfers with highest proficiency group had significantly greater balance as well as hip, torso, and shoulder flexibility/strength.

What most people think they look like…

What they actually look like…

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Table 4. Strength comparisons across proficiency level.*

	HCP < 0		HCP 0–9		HCP 10–20		
	Mean	± *SD*	Mean	± *SD*	Mean	± *SD*	*p* value†
Right hip abduction (%BW)‡§	153.5	41.5	127.7	36.1	121.6	34.4	<0.001
Right hip adduction (%BW)‡§	132.6	41.4	112.3	35.3	109.0	38.1	0.014
Right shoulder internal rotation (%BW)§	59.4	12.8	54.3	15.8	48.6	14.1	0.003
Right shoulder external rotation (%BW)§	40.5	7.4	38.5	7.1	36.0	9.3	0.029
Left hip abduction (%BW)‡§	153.9	40.4	134.4	34.4	124.6	35.5	<0.001
Left hip adduction (%BW)	128.0	36.2	112.5	33.9	110.7	39.4	0.077
Left shoulder internal rotation (%BW)	53.8	11.9	50.5	14.3	47.5	13.2	0.110
Left shoulder external rotation (%BW)§	40.1	7.2	36.9	8.1	35.1	7.8	0.019
Right torso rotation (%BW)‖	157.3	31.3	136.9	36.7	122.7	33.4	<0.001
Left torso rotation (%BW)‖	154.9	31.5	138.8	34.9	125.2	34.1	<0.001

* HCP = handicap index; BW = body weight.
† *p* values for 1-way analysis of variance across proficiency level.
‡ Significant difference observed between HCP < 0 and HCP 0–9 ($p < 0.05$).
§ Significant difference observed between HCP < 0 and HCP 10–20 ($p < 0.05$).
‖ Significant difference observed between each proficiency level ($p < 0.05$).

Table 6. Hip range of motion comparisons across proficiency level.*

	HCP < 0		HCP 0–9		HCP 10–20		
	Mean	± *SD*	Mean	± *SD*	Mean	± *SD*	*p* value†
Right hip flexion (°)	132.7	7.7	131.3	9.2	129.6	8.6	0.185
Right hip extension (°)‡	22.2	7.4	19.1	7.1	18.0	6.6	0.013
Right hip abduction (°)	30.4	9.2	32.8	8.7	30.8	9.2	0.332
Right hip adduction (°)	14.5	5.1	16.4	5.2	17.1	4.8	0.107
Left hip flexion (°)‡	134.3	8.9	132.3	9.7	129.5	8.9	0.024
Left hip extension (°)‡	20.8	6.3	18.2	7.2	15.9	6.1	0.002
Left hip abduction (°)	33.9	9.5	32.2	7.6	33.5	9.2	0.587
Left hip adduction (°)	16.6	3.8	16.7	5.2	16.9	4.3	0.957

* HCP = handicap index.
† *p* values for 1-way analysis of variance across proficiency level.
‡ Significant difference observed between HCP < 0 and HCP 10–20 ($p < 0.05$).

Physical Therapist: “What are your goals with PT?”
Patient: “To gain 3 strokes in my next golf outing.”

- Objective Measures
  - Golf Swing Analysis
  - Hip Mobility
    - Range of Motion
    - Special Test: FABER/FADIR, active straight leg raise
    - Joint Mobility: Femoroacetabular Joint Accessory Mobility
    - Muscle Length: Thomas Test
    - Movement Coordination: Quadruped Rockback
  - Strength
    - Abdominals/Core
    - Hip Adductors
    - Hip External/Internal Rotators
      - Gluteus Medius/Maximus
    - Quadriceps

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Possible Interventions

- Manual Therapy
  - Femoroacetabular Accessory Mobility
  - Movement with Mobilization (MWM)
- Therex
  - HIp Mobility Exercises
    - Self-Mobilization with Movement using Belt/Band Distraction
  - Core/Lower Extremity Strengthening
  - Movement Coordination
    - Lack of X-Factor due to poor coordination

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Potential Future Research

- Updating current research on golf swing mechanics
- Comparing hip ER/IR and trunk rotation ROM between different experience levels in golfers.

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Summary

- Deficits in hip mobility, especially the lead leg, can contribute to injuries from golf swings.
- Specific muscles activation at different phases of a golf swing should help guide our examination if physical therapist suspects power deficits.
- Educating the public about the importance of stretching and strengthening for golf.

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References

Cabri, J., Sousa, J. P., Kots, M., & Barreiros, J. (2009). Golf-related injuries: a systematic review. *European Journal of Sport Science*, *9*(6), 353-366.

Cole, M. H., & Grimshaw, P. N. (2016). The biomechanics of the modern golf swing: implications for lower back injuries. *Sports Medicine*, *46*, 339-351.

Dickenson, Edward, O'Connor, Philip, Robinson, Philip, Campbell, Robert, Ahmed, Imran, Fernandez, Miguel, Hawkes, Roger, Charles, Hutchinson and Griffin, Damian R.. (2016) Hip morphology in elite golfers : asymmetry between lead and trail hips. British Journal of Sports Medicine, 50 (17). pp. 1081-1086.

Murray, E., Birley, E., Twycross-Lewis, R., & Morrissey, D. (2009). The relationship between hip rotation range of movement and low back pain prevalence in amateur golfers: an observational study. *Physical Therapy in Sport*, *10*(4), 131-135.

Parziale, J. R., & Mallon, W. J. (2006). Golf injuries and rehabilitation. *Physical Medicine and Rehabilitation Clinics*, *17*(3), 589-607.

Sell, T. C., Tsai, Y. S., Smoliga, J. M., Myers, J. B., & Lephart, S. M. (2007). Strength, flexibility, and balance characteristics of highly proficient golfers. *The Journal of Strength & Conditioning Research*, *21*(4), 1166-1171.

Vad, V. B., Bhat, A. L., Basrai, D., Gebeh, A., Aspergren, D. D., & Andrews, J. R. (2004). Low back pain in professional golfers: the role of associated hip and low back range-of-motion deficits. *The American journal of sports medicine*, *32*(2), 494-497.

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