Lumbar Bracing and the Effect on Lumbar Motion During a Golf Swing

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Low back pain (LBP) in golfers is mainly caused by the torsional motion of the lumbar spine at the top of the swing and by overextension through the downswing and follow-through.

Stress on the lumbar spine is dependent on swinging technique.

Swing is terminated in a body position generally known as the “reverse C”.

Trunk hyperextension at the finish of a golf swing has been considered a risk factor for LBP.

Compared with asymptomatic amateur golfers, those with LBP have reduced hip rotation range during a golf swing.

Rapid spinal rotation velocity during a golf swing results in considerable spinal loading.
Reducing Incidence of LBP

- **Decreasing the amount of spinal motion** in the axial, sagittal, and coronal planes during golf swings can reduce compressive and torsional loads on the lumbar spine.
- **Reducing excessive motion by the lumbar spine** and **increasing the compensatory rotational motion of the hip joint** during a golf swing can reduce the incidence of low back-injuries.

Hashimoto, 2013
Kinematics Down the Chain

- Study looking at 15 professional golfers with no history of musculoskeletal injury and an average age of 31 years old
- Use of six infrared cameras and interface
- All participants showed similar movement patterns
- Demonstrates strong relationship between mobility of the lumbar spine and hip joints

Mun, 2015
A study using the VICON looked at difference in trunk mechanics without corset (WOC), with soft corset (SC) and with hard corset (HC):

- **Results:**
  - Extension angle was significantly lower SC or HC than WOC
  - Max angular velocity and lumbar rotation angles at top and finish were significantly smaller under HC than SC and WOC

- **Conclusion:** Wearing a lumbar corset while swinging a golf club can **effectively decrease lumbar extension and rotation angles** from impact to end of swing.

Hashimoto, 2013
Key points

- **Rotational and extension forces** on the lumbar spine may cause golf-related low back pain
- Wearing lumbar corsets during a golf swing can effectively **decrease lumbar extension and rotation angles and angular velocity**
- Wearing lumbar corsets increased the rotational motion of the hip joint while reducing the rotation of the lumbar spine

Hashimoto, 2013
Clinical Question

**Question:** What is the impact of low-back bracing on lumbar motion and swing kinematics during a golf swing and how altered kinematics will affect LBP?

**Hypothesis:** Lumbar bracing will decrease extension and rotational angles of the trunk which is often associated with increased LBP during a golf swing. This will also result as an increase in hip rotation to compensate for the loss of ROM in the lumbar spine.

**Rationale:** Based on previous research.
Methods

**Independent variable:** Low-back bracing versus not bracing

**Dependent variable:** Analyzed at the top, impact and finish of the swing cycle

1. Back right/left rotation, Back flexion/extension, Hip (L) internal/external rotation, Hip (L) flexion/extension, Hip (R) internal/external rotation, Hip (R) flexion/extension
2. Movement from Center of Pressure (lead vs. back foot)

*with a focus on extension and rotation of the lumbar spine, as well as, hip rotation

**Subjects:**

- Participant 1 (-LBP) Amateur golfer, Participant 2 (+LBP) Amateur golfer
- Participant 1 (-LBP) - 24 years old, average golf score 81
- Participant 2 (+LBP) - 76 years old, average golf score 78
Methods cont.

**Condition 1:** Participant 1 (-LBP) without brace

**Condition 2:** Participant 1 (-LBP) with brace

**Condition 3:** Participant 2 (+LBP) without brace

**Condition 4:** Participant 2 (+LBP) with brace

*The brace was cinched between the lower border of the ribs and just above iliac crest - same brace was used for both participants

**APDM Opal Sensor System:** Placement of sensors

  - Sternum, Upper Arm, Lumbar, Upper Leg, Wrist
Methods cont.

**Tasks performed per condition:**

3 full swings under maximal effort without brace, 3 full swings under maximal effort with the brace

7 iron swinging off of a golf mat, standing on force plates
Methods: Data Analysis

- Found times associated with top of swing, impact, and follow through for each trial using the back flex/ext graph.
- Averaged values for braced versus non-braced of all dependent variables.
- Created a graph representing average values at top of swing, impact, and follow through for each trial.
Methods: Data Analysis

- Data taken from force plate **medial-lateral direction** of both feet
- To calculate **net center of pressure (COP)**:

\[
COP_{net} = COP_L \frac{R_L}{R_L + R_R} + COP_R \frac{R_R}{R_L + R_R}
\]

(Eq. 3)

where: COP_L and COP_R are the COP’s under left and right feet respectively. \( R_L \) and \( R_R \) are the vertical reaction forces under left and right foot respectively.

- Graphs of net COP were then zeroed from starting position to account for initial position
- Averages were then taken at **start of swing, top of swing, impact, follow-through**

Winter, 1995
Results
Comparing Participant 1 No Brace to Brace:

- Increased **back extension at top of the swing** with brace
- Increased **(L) hip IR/ER at top of swing** with brace
- Increased **back (R) rotation and flexion** with the brace at **impact**
- Shift towards **ER for all motions** at the **(R) hip**
- Decrease in all **(R) & (L) hip flexion** values
Comparing Participant 2 No Brace to Brace:

- Decrease in all **back rotation** values with the brace
- Decrease in all **back flex/ext** values with the brace
- Increase in all **(L) & (R) hip motions** except at impact with the brace
Top of Swing

Participant 1
Participant 2

Brace
Impact

Participant 1

Participant 2

Brace
Follow through

Participant 1  Participant 2  Brace
Results

- Participant 1 had **increased R/L deviation** at top of swing with the brace and **decreased R/L deviation** during impact and follow through with brace.
- Participant 2 had **increased R/L deviation** during start of swing, impact and follow through with the brace.
- Participant 1 has **overall increased R/L deviation** than Participant 2 who has history of LBP.
Discussion

**Participant 1**: reject the null hypothesis

- Increased back angles with the brace $\rightarrow$ compensation
- Decrease in hip values

**Participant 2**: accept the null hypothesis

- Decrease in all back values with an increase in all hip values with the brace

**Clinical importance**: wearing a back brace decreases back angles during swing which decreases risk of back injury.
Strengths:
- Specialized patient population observed
- Ability to look specifically at bracing

Limitations:
- Inability to find exact time of start
- Back pain vs. no back pain
- Experience with the brace vs. no experience with the brace
- Variable swing mechanics
- Age of participants
Conclusion

- Using a brace for individuals with history of low back pain can:
  - Decrease back rotation
  - Decrease back flex/ext
  - Increase compensatory rotational movement of hip joint
- Which can be used to decrease incidence of low back injuries according to the literature.
- However, it requires practicing golf swings using the brace to have this effect for the participants in this study.
- **Clinical Implication:** If a patient comes in with low back pain and enjoys golfing, then a back brace could be recommended to decrease trunk kinematics that are associated with low back injuries.
- However, more research needs to be done to come to a conclusive recommendation.

Hashimoto, 2013
Resources:


