Effects of Upper-Body Flexibility Exercise on Golf Performance of Amateur Female Golfer: A Case Report

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Patient: Female, 43-year-old
Final Diagnosis: Amateur golfer
Symptoms: Golf swing
Medication: —
Clinical Procedure: —
Specialty: Public Health • Rehabilitation

Objective: Unusual or unexpected effect of treatment
Background: We investigated the effects of the upper-body flexibility exercises on the golf performance of a female amateur golfer.
Case Report: The participant was a 43-year-old woman who performed a general golf swing exercise (30 min) and an upper-body flexibility exercise (20 min) 3 times a week, for a total of 6 times in 2 weeks. The maximum rotation angle of the upper body was measured using a goniometer. To measure the X-factor, the numerical value was measured after subtracting the rotation angle of the lower-body from the rotation angle of the upper body when the participant stopped making a back-swing top motion. A camera measuring instrument was used to measure the clubhead speed and carry distance of the golf ball when she hit the ball with a no. 7 iron club. After the exercises, the maximum rotation angle of the participant’s upper body increased from 40° to 69°, and the X-factor increased from 10° to 24°. The clubhead speed increased from 29.4 m/s to 34.4 m/s, and the carry distance increased from 84 m to 106 m.

Conclusions: The participant responded positively to the upper-body flexibility exercises, and there was improved upper-body mobility, X-factor, clubhead speed, and carry distance. Our results showed that upper-body flexibility exercises with a general golf swing exercise for female amateur golfers may improve golf performance.

Keywords: Case Reports • Exercise • Golf

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**Background**

Golf is a sport that is played by about 55 to 80 million people in more than 130 countries [1]. Golf involves low intensity exercise as players walk 100 to 600 yards across the golf course from one hole to the next and high intensity exercise as they swing at the ball. Golf courses have 18 holes, and players use 14 types of golf clubs for swinging and putting to get the ball into the holes. The goal of golf is to finish the game with the fewest hits of the ball. A long-term goal is to continue playing golf without pain or injury [2].

To golf well, a player must be able to send the golf ball in the aimed direction and for a long carry distance (the length the ball travels before touching the ground). During the golf swing, a player needs the ability to send the ball far by accelerating the golf club maximally and accurately [3]. Factors used to evaluate golf performance include the X-factor (the difference in the maximum rotation angle of the shoulders and the maximum rotation angle of the pelvis in the backswing top position in a golf swing [4]), kinematic sequence of body segments, clubhead speed, smash factor (the ratio between clubhead speed and ball speed), and the player’s maintaining the tilt of the spine angle during a swing (spine angle).

To send the ball far, a player’s twist of the trunk should maximize volume in the swing of the golf club [5]. In a previous study, the higher scores players had in a golf movement screening test, which consisted of motions such as 1-leg standing, lunging, trunk rotating, and squatting, the bigger X-factor they made in a golf swing [6]. In a study conducted with a skilled golfer, the flexibility of the player’s trunk had significant correlations with the X-factor and clubhead speed [7].

Exercises combining flexibility, muscle strengthening, and balance improve golf performance, including carry distance, and elite players use weight training to enhance the basic functions of the body, such as flexibility, muscle strength, and balance. However, it is difficult for amateur golfers to use professional training and equipment. There are currently insufficient studies on training programs that players can easily use to promote physical functions they lack without needing any special equipment.

Thus, in this study, we used an upper-body flexibility exercise program in a female amateur golfer to investigate changes in the maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance and measured their impact on the improvement of her golf performance.

**Tests and Measurements**

To measure the X-factor, the numerical value was measured after subtracting the rotation angle of the lower-body from the rotation angle of the upper body when she stopped making a back-swing to in her posture while addressing the ball. A goniometer was used to measure the maximum rotation angle of the upper body and X-factor [8].

A camera measuring instrument (7105 ARC, Maum Golf, Republic of Korea) was used to measure the clubhead speed and the carry distance of the ball. Using a no. 7 iron club, and after a practice swing, the best value of 3 hits was chosen. The camera measuring instrument indicated the clubhead speed and carry distance by measuring the speed and spin volume of the golf ball at 3800 frames per s while the participant was hitting the marked golf ball.

**Case Report**

**Case Description**

The participant was a 43-year-old woman who had been playing golf for 1 year and 5 months and had a handicap of 20. She had been participating in golf swing training 4 to 5 times a week in an indoor driving range, and her average practice time per session was 1 h. She had not been doing any exercises other than golf swing practice and did not feel pain during a golf swing.

In this study, she participated in training for 1 h, including a warm-up exercise for 5 min, upper-body flexibility exercise for 20 min, golf swing exercise for 30 min, and cool-down exercise for 5 min. She did the exercises 3 times a week, for a total of 6 times in 2 weeks. Before and after each exercise, the same examiner measured the maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance.

**Upper-Body Flexibility Exercise Program**

Four types of upper-body flexibility exercises were used. Before beginning, the participant received 10 min of explanation so she could understand the exercise program. She did each detailed
exercise for 4 min and had a 1-min break between each exercise. The exercise instructions were as follows:

Open book drill (Figure 1)
Bend the knees and hip joint to the maximum in the lateral position and hold and fix the upper knees with the hand located on the ground. Turn the chest to the maximum range, covering the chest with the arm located at the upper side. Repeat the same motion while stretching the arm that covered the chest to the maximum length. Do the same on the opposite side.

Reach under drill (Figure 2)
Place 1 hand behind the head in the 4-point kneeling position. Put the elbow of that hand as close as possible next to the head as close and point it toward the direction of the opposite knee while keeping the hand on the head. Do the same on the opposite side.

Prayer stretch (Figure 3)
Sit on the floor with the buttock to the heels. Slowly bend the upper body, stretching the arms forwards. Do lateral bending to both sides, keeping the posture.

Torso turns with a side bend (Figure 4)
Cover the chest with both arms, sitting on the chair. Turn to the right and bend laterally to the right in the maximum rotation range. Return to the original position in the lateral bending state and turn to the right again. Continue until the rotation range will not increase any more through repeated movement. Do the same on the opposite side.

Golf swing exercise
The golf swing exercise consisted of a half swing for 5 min, three-quarter swing for 5 min, and full swing for 20 min, in addition to a warm-up exercise and cool-down exercise, respectively, for 5 min.
### Results

Changes according to exercise in the rotation angle of the upper body, X-factor, clubhead speed, and carry distance are shown in Table 1.

The participant had a clubhead speed of 29.4 m/s before the exercise, which increased to 30.8 m/s after the first exercise; 30.0 m/s after the second; 31.1 m/s after the third; 32.2 m/s after the fourth; 33.8 m/s after the fifth; and 34.4 m/s after the sixth. Compared with the speed before the beginning of the exercise, the clubhead speed increased by about 17% after the final exercise.

The participant had a carry distance of 84 m before the exercise, which increased to 99 m after the first exercise; 84.7 m after the second; 96.6 m after the third; 94 m after the fourth; 101 m after the fifth; and 106 m after the sixth. Compared with the distance before beginning the exercise, the carry distance increased by about 26% after the final exercise.

The participant had a rotation angle of 40° in the measurement of the upper body before the exercise, which increased to 60° after the first exercise; 65° after the second; 66° after the third; 64° after the fourth; 66° after the fifth; and 69° after the sixth. Compared with the time before beginning the exercise, the rotation angle of the upper body increased by about 73% after the final exercise.

The participant had an X-factor of 10° before the exercise, which increased to 20° after the first exercise; 20° after the second; 21° after the third; 20° after the fourth; 22° after the fifth; and 24° after the sixth. Compared with the time before beginning the exercise, the X-factor increased by about 140% after the final exercise.

### Discussion

In this study, we investigated the effects of upper-body flexibility exercises with a golf swing exercise on the performance of a female amateur golfer. The implementation of the exercises for 2 weeks showed that the maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance improved with the increase in the number of times the exercise was performed.

Repeating the upper-body flexibility exercises (upper-body flexion, extension, lateral bending, and rotation) increased the

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**Table 1.** Changes in the maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance.

| Variables           | Session 1 | Session 2 | Session 3 | Session 4 | Session 5 | Session 6 |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| MRU (°)             | Before    | 40        | 50        | 50        | 44        | 48        | 51        |
|                     | After     | 60        | 65        | 66        | 64        | 66        | 69        |
| X-factor (°)        | Before    | 10        | 18        | 16        | 13        | 17        | 18        |
|                     | After     | 20        | 20        | 21        | 20        | 22        | 24        |
| Clubhead speed (m/s)| Before    | 29.4      | 29.0      | 28.5      | 28.2      | 30.1      | 30.7      |
|                     | After     | 30.8      | 30.0      | 31.1      | 32.2      | 33.8      | 34.4      |
| Carry distance (m)  | Before    | 84        | 82.2      | 83.4      | 80.1      | 88        | 91        |
|                     | After     | 99        | 84.7      | 96.6      | 94        | 101       | 106       |

MRU – maximum rotation angle of the upper body.
golf swing rotation by making the entire movement smooth through the increase in movement between the segments of the spine. Joint flexibility is essential for swing mechanics [9] and allows the maintenance of the correct swing path in a golf swing, increasing the range of body motion [10]. Also, a previous study showed significant correlations between body flexibility, X-factor, and clubhead speed [11], supporting the results of the present study.

A variety of exercises have been reported to increase clubhead speed and carry distance, including using a vibrating apparatus [12], resistance band [13], golf-specific resistance training [14], multimodal exercise [15], plyometrics training [16], and weight stick [17] to increase golfer performance.

Since most amateur golfers do not practice warm-up or cool-down exercises when golfing and do not have access to professional training and equipment, it is necessary to set an exercise program that can be implemented without any special equipment. A previous study found that upper-body flexibility exercise is an efficient exercise in terms of time and effect [18].

We found that the upper-body flexibility exercise practiced with golf swing exercise brought about positive changes in a female amateur golfer’s maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance.

Conclusions

In this case report, we investigated the effects of upper-body flexibility exercises with a golf swing exercise on a female amateur golfer’s maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance. After the exercises, all of these factors were improved. Upper-body flexibility exercises with a golf swing exercise might have positive effects on a female amateur golfer’s maximum rotation angle of the upper body, X-factor, clubhead speed, and carry distance. We believe that through conducting further high-quality studies, these exercises may be found effective for use by female amateur golfers.

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