Effects of an 8-Week Multimodal Exercise Program on Strength, Flexibility, and Golf Performance in 55- to 79-Year-Old Men

Christian J. Thompson and Wayne H. Osness

Substantial research has indicated the beneficial effect of physical activity on physical fitness and activities of daily living in older adults, but none have investigated the effects on performance of recreational activities. This investigation studied the effect of an exercise program on fitness and golf-clubhead speed in older men. Thirty-one golfers (mean age 65.1 ± 6.2 years) were randomly assigned to a treatment (n = 19) or control (n = 12) group. The treatment group completed an 8-week strength and flexibility program. Assessments included 10-RM muscle strength; selected range-of-motion (ROM) measurements; and golf-clubhead speed (CHS). ANCOVA revealed significant differences between groups (p < .005) for all strength measurements and several ROM measurements. CHS was significantly different (p < .05) between groups after the intervention. Mean CHS improved from 85.0 to 87.1 miles/hr (136.8 to 140.2 km/hr). These results indicate that a strength and flexibility program can improve golf performance in older adults.

Key Words: fitness, training, clubhead speed, recreation, quality of life

It has been well established that regular participation in exercise has a positive effect on the health of older adults and their ability to perform activities of daily living (Brill et al., 1998; Mihalko & McAuley, 1996; Rantanen et al., 1999). Maintaining activities of daily living alone, however, does not ensure a high quality of life in old age. Quality of life is multifactorial and includes physical, social, and emotional dimensions. In order to maintain a high quality of life, many older adults engage in recreational activities such as golf that provide enjoyment, social interaction, and physical exercise. Gravelle, Pare, and Laurencelle (1997) determined that active older adults select exercises that they deem to be enjoyable and beneficial for them, thus resulting in maintenance of physical activity through the later years. Although there has been some research to indicate that motor-skill performance of a golf swing is related to physical capabilities, no research has investigated the effect of an exercise program on the performance of recreational activities such as golf, tennis, or other sports in older adults (Langley, 2001; Steinberg & Glass, 2001).

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Golf is one of the most popular leisure-time activities in the United States. In the past decade, it has enjoyed tremendous growth because of a number of factors including increased golf-course construction and increased media coverage. In 2000, the National Golf Foundation reported that there were 26.4 million golfers in the United States, with 564 million rounds of golf played. Among these 26.4 million golfers, 12 million are seniors (over the age of 50). Senior golfers averaged 37 rounds per year in 1999, representing the highest number of rounds per year among all age groups (National Golf Foundation, 2000).

Golf itself is an excellent mode of physical activity, provided that the golfer walks the course. Recently, there have been several studies that have demonstrated immediate physiologic benefits from walking a round of golf, including moderate increases in heart rate, energy expenditure close to 1,000 kcal, and an increase in fat utilization for energy (Magnusson, 1999; Murase, Sadatsugu, & Hoshikawa, 1989). In addition, two training studies that examined the effect of walking a golf course in middle-aged men demonstrated reductions in total cholesterol and low-density lipoprotein and an increase in high-density lipoprotein when playing golf at least three times per week (Palank & Hargreaves, 1990; Parkkarri et al., 2000). These data suggest that older adults can benefit greatly from regular golf participation, and improving the physical conditioning of older golfers might enable them to golf more effectively and with less risk for injury (Batt, 1993; Stover & Stoltz, 1996).

Although it has the potential to confer substantial health benefits, playing golf does not require high levels of physical fitness, one possible reason for its popularity among older individuals. Even so, golf does have certain physical demands, and the importance of proper conditioning for golfers cannot be underestimated. Poorly conditioned golfers are at greater risk for injury, and the risk compounds as an individual ages (Batt, 1993). Recently there has been an explosion in the development of physical-fitness programming for golfers. Many highly visible golfers on the PGA tour have undertaken vigorous exercise programs with the hope that their improvements in fitness will be reflected in their golf performance (Graves, 2000). Older professionals on the senior PGA tour either have been involved in exercise for years already or are beginning to exercise with the hope that increased physical activity will help them maintain their competitiveness and avoid injury.

Recently, research has begun to investigate the effect of physical activity on golf performance (Hetu, Christie, & Faigenbaum, 1998; Jones, 1998; Wescott & Parziale, 1997). In 1998, Hetu and colleagues investigated the effect that an 8-week program of strength training, flexibility training, and plyometrics had on the clubhead speed of 17 middle-aged golfers ($M = 52.4$ years, $SD = 6.7$ years). Results indicated that all fitness measurements improved significantly and clubhead speed increased significantly by 3.0 miles/hr.

Wescott and Parziale (1997) conducted two studies to assess the importance of flexibility and strength training on clubhead speed. The first study investigated a combined strength- and flexibility-training program and its effect on clubhead speed in 17 middle-aged golfers (mean age 57.8 years). The results demonstrated significant improvements in muscle strength and flexibility measurements. Clubhead speed increased significantly, by 5.0 miles/hr. A small control group of 5 participants showed no improvements in any performance measure during the 8-week program.

In the same publication, Wescott and Parziale (1997) reported the findings of a second 8-week study conducted to determine the effect of weight training alone
on clubhead speed in 31 middle-aged participants (mean age 51.7 years). The results showed that the participants improved significantly in muscle strength, but all flexibility measurements remained the same after the weight-training program. Clubhead speed increased significantly, but by only 3.0 miles/hr. The authors concluded that both flexibility and weight training exert a positive influence on clubhead speed. In addition, Jones (1998) determined that an 8-week stretching program of proprioceptive neuromuscular facilitation resulted in a 5.5-mile-per-hr increase in clubhead speed in 16 middle-aged golfers (mean age 51.9 years, $SD = 4.9$).

Despite the positive findings from conditioning interventions, there have been two studies that have indicated that physiological parameters have only a modest effect on golf performance (Kras & Abendroth-Smith, 2001; Thompson, 2002). Golf performance is multifactorial, and other parameters such as swing mechanics, mental preparation, and golf equipment are implicated in golfing success. Nevertheless, the results of conditioning studies have provided a rationale for physical conditioning as a modality for improving the physical factors affecting golf performance.

The previously noted investigations were not without methodological limitations. Only one included a control group, and that was a group of only 5 people. In addition, although previous investigations included older golfers in their samples, no study has been performed on an exclusively older population. Thus, it was the purpose of this investigation to determine whether a multidimensional conditioning program would elicit improvements in specific fitness parameters and clubhead speed in older male recreational golfers as compared with a control group of golfers.

**Methods**

**PARTICIPANT RECRUITMENT**

The study was promoted locally through print and video media. Before being enrolled in the study, interested participants were interviewed by the researchers to ensure that they met the study requirements.

Data were collected from 31 male recreational golfers age 55–79 years ($M = 64.8 \pm 6.1$). Skill level was not a criterion for eligibility, so the sample consisted of players of all handicap levels. All participants obtained written physician clearance to participate in the investigation.

**STUDY DESIGN**

Participants were assigned in a random manner to one of two groups. Nineteen were assigned to a treatment group that participated in an 8-week conditioning program from late January to early March, and 12 were assigned to a control group and instructed to continue their current level of physical activity during that time period. A larger portion of the sample was placed into the treatment group in order to accommodate any attrition during the program. Treatment-group participants were instructed not to begin any other new physical activities during the 8-week period. In addition, in order to decrease any possibility of changes in skill confounding the
clubhead-speed results, all participants were instructed to not take any golf lessons during the course of the program. Data collection was performed before and at the completion of the 8-week program.

DATA COLLECTION

Muscle-strength, range-of-motion, and clubhead-speed testing were performed on all participants. Muscle strength was determined by 10-repetition-maximum (10-RM) strength tests on the following Universal Fitness (Cedar Rapids, IA) weight machines: leg press, leg extension, leg curl, shoulder press, lat pull-down, seated row, biceps curl, back extension, and abdominal crunch. The 10-RM protocol is commonly used to assess muscle strength in older adults (Braith, Graves, Leggett, & Pollock, 1993; Wescott & Parziale, 1997). The 10-RM was determined in three or less attempts for all participants, with a 2-min rest between attempts.

Standardized range-of-motion testing as described by Norkin and White (1993) was performed for the following joint movements using a goniometer (Baseline, Kom Kare, Cincinnati, OH): shoulder flexion, extension, and abduction; internal and external shoulder rotation; trunk rotation; lateral trunk flexion; hip flexion; and internal and external hip rotation. Measurements were recorded in degrees and were taken on the right side of the body. Three trials were performed, and the average of the three trials was used in data analysis.

When assessing a golfer’s performance, it is important to realize that golf is a sport with much subjectivity. The scores a golfer records depend on many factors, both internal and external. Skill, although important, is not the only factor that determines scoring success. Other factors such as equipment, weather conditions, course conditions, course knowledge, and level of concentration play a role in a golfer’s performance. The best objective measurement that reflects golf performance is clubhead speed. Clubhead speed is directly proportional to the distance a golf ball will travel and influenced solely by the body’s ability to apply force to the golf ball. Virtually all the literature that pertains to the effect of conditioning on golf performance analyzed clubhead speed as the dependent variable (Hetu et al., 1998; Jones, 1998; Wescott & Parziale, 1997).

For all participants, clubhead speed of a driver (Toski Multimetal, 10° loft, 45’’) was measured on a VideoMentor swing analyzer (DeadSolid Golf®, Pittston, PA) located at a local golf retail store. The VideoMentor is a computer-integrated system that measures clubhead speed by photoelectric analysis. It is designed to track the motion of the head of the golf club during its approach to and impact on a golf ball. Using the VideoMentor, clubhead speed is calculated in 1.0-mile-per-hr (1.6 km-per-hr) increments and can range from 10 to 140 miles/hr (16.1 to 225.0 km/hr). Measurement error for the VideoMentor is ±0.5 miles/hr (0.8 km/hr). Before each testing session, the swing analyzer was calibrated using a SpeedChek sport radar gun (Astro Products, Chino, CA). The participant was allowed to warm up with a 5-iron from the demonstration club bag until he felt comfortable to swing the driver. This warm-up was designed to familiarize the participant with the VideoMentor equipment and to reduce any pretest anxiety. The participant then hit five drives into the net using the driver. The participant was not allowed to view his swing speed. Once the participant had finished the five swings, the highest and
lowest speeds were dropped to eliminate either a very poor swing or an uncharacteristically good one. The remaining three clubhead speeds were averaged, and the resulting value was used in data analysis.

DESCRIPTION OF THE INTERVENTION

The exercise sessions were held in the recreation center on campus at the University of Kansas. The primary researcher supervised all exercise sessions. Each participant was required to attend at least 24 exercise sessions during the 8-week period. All 19 participants in the treatment group met the minimum exercise requirement, resulting in an unequal number of participants in the treatment and control groups.

On arriving at the training facility, participants completed a short aerobic warm-up on a treadmill or stationary cycle and then proceeded to the weight room. Weight training consisted of one set of 12 repetitions on the following weight machines: chest press, leg press, biceps curl, lat pull-down, abdominal crunch, leg extension, seated row, shoulder press, leg curl, and back extension. Participants were instructed to alternate upper body and lower body exercises. Repetitions were done through the full range of motion in a slow and controlled manner. The weight selected was as close as possible to 80% of each participant’s measured 10-RM by choosing the appropriate weight on the weight stack. After the 12th exercise session, all training weights were increased by 4.5 kg. Thereafter, as the participant noticed improvements in muscle strength, reflected by a decrease in difficulty of completing 12 repetitions, the primary researcher increased training loads in 4.5-kg increments. Each participant increased training load on all pieces of equipment by at least 9.0 kg during the 8-week intervention.

After the resistance component of the exercise session, the participant stretched for flexibility. Flexibility training was conducted in a carpeted room and incorporated both static and dynamic stretches to increase range of motion at the primary joints involved in the golf swing. All static stretches were held for approximately 20 s and included lateral trunk side bends, chest-muscle stretch, posterior and inferior shoulder stretch, back-extensor stretch by a knee-to-chest technique, standing quadriceps stretch, crocodile stretch for the spine and hip, and a seated hamstring stretch. Static stretches were held at the point of mild tension so as to not activate the stretch reflex. Dynamic stretching techniques were performed in a slow and controlled motion for approximately 30 s and included the “angry cat” stretch for back extension and flexion and standing lateral trunk rotations. These stretches have been previously described in golf-fitness and older-adult literature as safe and effective for improving range of motion (Jobe & Schwab, 1991; Leslie & Frekany, 1975; Pink, Jobe, Yocum, & Mottram, 1996; Stover & Stoltz, 1996). At the conclusion of each exercise session, the participant completed a short golf-specific exercise, swinging a 1.3-kg weighted club in a slow and controlled manner 10 times consecutively.

STATISTICAL ANALYSIS

Subsequent to data collection, data entry was verified by comparing a printout of data with the original data sheets. The following data were dependent variables: 10-RM for chest press, leg press, shoulder press, leg curl, lat pull-down, leg extension, biceps curl, back extension, abdominal crunch, and seated row. Range of motion for
shoulder and abduction, internal and external shoulder rotation, trunk rotation and flexion, hip flexion, internal and external hip rotation, and average clubhead speed were also measured. Data were analyzed using SPSS, version 9.0. Analyses included preliminary, descriptive data for all dependent variables and analysis of covariance (ANCOVA) to determine group pretest-to-posttest differences between treatment and control groups for all dependent variables. Pretest measurements were used as the covariate in order to control for any differences between treatment and control groups at pretesting. Each strength measurement was assumed to be somewhat dependent on all other strength measurements, so a Bonferroni correction was applied, and comparisons were considered significant at $p < .005$. The same Bonferroni correction was applied to flexibility measurements, resulting in significance being set at $p < .005$. Clubhead speed was considered significant at $p < .05$.

**Results**

Table 1 summarizes the descriptive characteristics of the sample. Results of the ANCOVA tests measuring posttest differences between the treatment and control groups for each strength measurement were all significant, with $p \leq .005$. Effect sizes were all above .35, indicating a strong association between gains in strength and participation in the exercise intervention. Treatment-group increases in strength ranged from a 60.4% increase on biceps curl to a 21.3% increase on lat pull-down. Strength results are reported in Table 2. Percentage-change measures for the treatment and control groups are presented graphically in Figure 1.

Results of the ANCOVA tests for range-of-motion measurements were mixed. Posttest differences between the treatment and control groups for shoulder abduction, internal and external shoulder rotation, and trunk flexion and rotation were significant, with $p \leq .005$. Effect sizes were all above .25, indicating a strong association between gains in range of motion and participation in the exercise intervention. Treatment-group increases in range of motion ranged from a 34.4% increase in trunk rotation to a 16.5% increase in shoulder abduction. Posttest differences between the treatment and control groups for shoulder flexion, hip flexion, and external hip rotation approached significance, and moderate effect sizes indicated that a larger sample size might have produced a significant result. Internal hip rotation, however, showed no response to the exercise intervention. Range-of-motion results are listed in Table 3. Percentage-change measures for both groups are represented graphically in Figure 2.

<table>
<thead>
<tr>
<th>Group assignment</th>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
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<tbody>
<tr>
<td>Treatment ($n = 19$)</td>
<td>$64.3 \pm 6.2$</td>
<td>$177.5 \pm 6.6$</td>
<td>$81.2 \pm 3.2$</td>
</tr>
<tr>
<td>Control ($n = 12$)</td>
<td>$66.2 \pm 5.9$</td>
<td>$178.3 \pm 6.2$</td>
<td>$83.0 \pm 2.7$</td>
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</tbody>
</table>
Mean clubhead speed for the treatment group increased from 85.0 miles/hr (187.0 km/hr) before the 8-week conditioning program to 87.1 miles/hr (191.6 km/hr) after the program. This represents a 2.7% increase in clubhead speed. Mean clubhead speed for the control group showed a slight decrease from 80.3 miles/hr (176.6 km/hr) to 79.8 miles/hr (175.6 km/hr). Clubhead-speed changes for both groups are represented in Figure 3. The ANCOVA comparing the treatment and control groups was significant, with \( p < .05 \). The effect size of .27 indicates a strong
Figure 1. Percentage improvement in muscle strength over the 8-week conditioning period.

Note. SF = shoulder flexion; SA = shoulder abduction; ISR = internal shoulder rotation; ESR = external shoulder rotation; TF = trunk flexion; TR = trunk rotation; HF = hip flexion; IHR = internal hip rotation; EHR = external hip rotation.

Figure 2. Percentage improvement in range of motion over the 8-week conditioning period.
Table 3 Changes in Range of Motion During the Intervention

<table>
<thead>
<tr>
<th>Measure (10-RM)</th>
<th>Pretest (M ± SD)</th>
<th>Posttest (M ± SD)</th>
<th>% diff.</th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
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<td></td>
<td></td>
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<tr>
<td>treatment</td>
<td>156.1 ± 9.0</td>
<td>162.9 ± 6.7</td>
<td>8.8</td>
<td>7.69</td>
<td>.010</td>
<td>.22</td>
</tr>
<tr>
<td>control</td>
<td>154.5 ± 8.0</td>
<td>156.8 ± 4.5</td>
<td>1.4</td>
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<tr>
<td>SA</td>
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<tr>
<td>treatment</td>
<td>129.3 ± 9.4</td>
<td>150.7 ± 0.1</td>
<td>16.5</td>
<td>22.22</td>
<td>.000*</td>
<td>.44</td>
</tr>
<tr>
<td>control</td>
<td>120.4 ± 8.4</td>
<td>129.7 ± 8.3</td>
<td>7.8</td>
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<tr>
<td>ISR</td>
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<tr>
<td>treatment</td>
<td>54.4 ± 7.3</td>
<td>67.6 ± 6.3</td>
<td>24.2</td>
<td>33.18</td>
<td>.000*</td>
<td>.54</td>
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<tr>
<td>control</td>
<td>48.0 ± 9.2</td>
<td>53.7 ± 4.8</td>
<td>11.8</td>
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<td>ESR</td>
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<tr>
<td>treatment</td>
<td>75.0 ± 12.9</td>
<td>88.6 ± 9.3</td>
<td>18.2</td>
<td>16.84</td>
<td>.000*</td>
<td>.38</td>
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<tr>
<td>control</td>
<td>72.4 ± 14.0</td>
<td>74.3 ± 10.7</td>
<td>2.5</td>
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<tr>
<td>treatment</td>
<td>24.9 ± 5.1</td>
<td>29.5 ± 4.2</td>
<td>18.7</td>
<td>10.32</td>
<td>.003*</td>
<td>.27</td>
</tr>
<tr>
<td>control</td>
<td>21.6 ± 6.5</td>
<td>23.0 ± 5.4</td>
<td>6.6</td>
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<tr>
<td>treatment</td>
<td>54.3 ± 15.4</td>
<td>73.0 ± 9.9</td>
<td>34.4</td>
<td>22.30</td>
<td>.000*</td>
<td>.44</td>
</tr>
<tr>
<td>control</td>
<td>46.3 ± 16.1</td>
<td>52.3 ± 14.5</td>
<td>13.2</td>
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<td>HF</td>
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<tr>
<td>treatment</td>
<td>102.6 ± 6.8</td>
<td>113.8 ± 5.4</td>
<td>10.8</td>
<td>8.33</td>
<td>.007</td>
<td>.23</td>
</tr>
<tr>
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<td>101.6 ± 7.5</td>
<td>107.7 ± 7.5</td>
<td>6.0</td>
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<tr>
<td>treatment</td>
<td>40.1 ± 4.6</td>
<td>40.7 ± 6.9</td>
<td>1.5</td>
<td>1.93</td>
<td>.183</td>
<td>.06</td>
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<tr>
<td>control</td>
<td>32.9 ± 6.5</td>
<td>33.1 ± 6.6</td>
<td>0.6</td>
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</tr>
<tr>
<td>treatment</td>
<td>34.9 ± 8.0</td>
<td>41.9 ± 6.3</td>
<td>19.8</td>
<td>7.44</td>
<td>.011</td>
<td>.21</td>
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<tr>
<td>control</td>
<td>32.9 ± 7.1</td>
<td>35.4 ± 5.6</td>
<td>4.2</td>
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</table>

Note. SF = shoulder flexion; SA = shoulder abduction; ISR = internal shoulder rotation; ESR = external shoulder rotation; TF = trunk flexion; TR = trunk rotation; HF = hip flexion; IHR = internal hip rotation; EHR = external hip rotation.

*p < .005.

association between improvements in clubhead speed and participation in the exercise intervention.

**Discussion**

The dramatic improvements in muscle strength for all 10 strength measurements were expected. It has been well established that participation in a regular weight-training program will have a significant effect on muscle strength in older adults...
Although the participants in this investigation played golf regularly, none had participated in a weight-training program for at least 2 years. It has been established that untrained older adults involved in a resistance-training program improve muscle strength rapidly (ACSM, 1998a; Braith et al., 1993; Cavani, Mier, Musto, & Tummers, 2002; Evans, 1999; Frontera, Meredith, O’Reilly, Knutgen, & Evans, 1988). Research has indicated an improvement in muscle strength of 50–100% in a period of 6 months (Bemben, Fetters, Bemben, Nabavi, & Koh, 2000; Brill et al., 1998; Frontera et al.). Each of these studies used multiple sets of lifts for each muscle group. In our investigation, a single set of 12 repetitions for each exercise was used to provide the training stimulus. This protocol was chosen in order to provide a total-body strength program while still allowing daily exercise sessions to be less than 1 hr in length. Even so, during the 2 months of the investigation all strength measurements increased between 21.3% and 60.4%.

The overall increase in shoulder flexibility is attributable to the selection of flexibility exercises in the program. The chest stretch, inferior shoulder stretch, and posterior shoulder stretch were all intended to mobilize the soft tissue in the shoulder region. The improvement in shoulder flexibility is similar to that of golfers in the combined strength and flexibility program of Wescott and Parziale (1997), in which shoulder abduction increased 11.9% after the 8-week program. In our investigation, shoulder abduction increased 16.5%. It is possible that the nonsignificant result in shoulder flexion is attributable to the small sample size. An effect size of .22 from the ANCOVA on shoulder flexion suggests that an increase in sample size might have resulted in a significant difference between the treatment and control groups.

The overall increase in trunk flexibility is attributable to the selection of trunk exercises in the program. The lateral trunk bends, back-extensor stretch, crocodile stretch, angry cat stretch, and trunk rotations were all intended to mobilize the trunk. Improvements of 18.7% in trunk flexion and 34.4% in trunk rotation were found in
this investigation. This improvement in trunk flexibility is similar to those found in another study on golfers (Hetu et al., 1998), in which a 47.3% improvement in trunk rotation was found. The results also concur with those of Rider and Daly (1991), who studied 20 older women to assess spinal mobility in response to a flexibility-training program. Their results indicated that spinal mobility, as measured by thoracic and lumbar rotation and lateral flexion, increased significantly from baseline in their training group, and the control group showed no change from baseline.

The lack of increase in hip flexibility is somewhat more difficult to explain. The standing quadriceps stretch, seated hamstring stretch, and crocodile stretch were all done to mobilize the hip. Although nonsignificant, the measures of hip flexion (10.8% improvement) and external hip rotation (19.8% improvement) both showed a trend of improvement. Moderate effect sizes (.23 for hip flexion and .21 for external hip rotation) indicate that a larger sample size might have resulted in significant differences in flexibility between the treatment and control groups.

The participants in the treatment group in this investigation increased their average clubhead speed by 2.1 miles/hr (3.4 km/hr) after the 8-week conditioning program, whereas the control group remained relatively the same, with a 0.5 miles/hr (0.8 km/hr) loss in clubhead speed. This result has both statistical significance and practical importance. A 2.1-mile-per-hr improvement in driver swing speed will result in approximately 6 more yards of carry distance off the tee and likely more roll distance, as well. This will typically result in the need for one less club to be hit into the green. For example, on a 400-m par-4 hole, a drive hit 250 m will leave the golfer with a 6-iron into the green from 150 m. If the drive is hit 260 m, however, then likely only a 7-iron will be needed from 140 m. The use of a 7-iron over a 6-iron has several performance benefits. It will result in a higher shot that has less sidespin, has more backspin, flies straighter, and lands softer. Provided that the golfer strikes the ball well during a full round of golf, he likely will score better when hitting shorter irons into greens.

Although the increase in clubhead speed was significant, the results of this investigation show smaller improvements in clubhead speed than did earlier studies. Previous studies all noted improvements in clubhead speed of at least 3.0 miles/hr, as compared with 2.1 miles/hr in the present investigation (Hetu et al., 1998; Jones, 1998; Wescott & Parziale, 1997). A possible reason for the smaller improvement might be the difference in initial clubhead speed between this investigation and previous ones.

Although the participants in this investigation were older than in any previous study, they exhibited a greater initial clubhead speed than all but one previous investigation. The mean clubhead speed for the treatment group before the conditioning program (85.0 miles/hr) was greater than that of Jones (77.3 miles/hr; 1998), Hetu et al. (49.0 miles/hr; 1998), and Wescott and Parziale (82.4 miles/hr; 1997). Only Wescott and Parziale’s strength study exhibited a higher initial clubhead speed (86.6 miles/hr). Although no norms have been established for average clubhead speed by age group, the participants in this investigation were likely at a higher level of initial clubhead speed for their age group than those in previous studies were for their younger age groups. It is possible a ceiling effect might be encountered in golfers who already have very high relative swing speeds.
Future research should be done to investigate the ceiling-effect theory.

It is also important to recognize that the benefits of improved physical condition might have implications beyond the generation of clubhead speed. Improved fitness enables golfers to experience less fatigue and perform more effectively, especially during the latter part of a round or in extreme weather conditions. In addition, there is evidence that improved physical fitness is correlated with reduced injury risk for golfers (Batt, 1993; Stover & Stoltz, 1996). Thus, regular participation in a structured exercise program might enable older golfers to play the game with greater enjoyment and less risk of injury.

Participation in recreational activities is an important contributor to quality of life for older adults (Gravelle & Laurencelle, 1997). In addition, playing golf has the potential to confer substantial health benefits (Murase et al., 1989; Palank & Hargreaves, 1990; Parkkarri et al., 2000). This study demonstrated the beneficial effect that participation in regular exercise has on golf performance. Future research should investigate the relationship of improved golf performance with the frequency of golf participation in older adults and its effect on their quality of life.

References


