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Effect of spinal manipulative therapy with stretching compared with stretching alone on full-swing performance of golf players: a randomized pilot trial☆

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Abstract

Objective: There has been a steady growth of chiropractic treatment using spinal manipulative therapy (SMT) that aims to increase the performance of athletes in various sports. This study evaluates the effect of SMT by chiropractors on the performance of golf players.

Methods: Golfers of 2 golf clubs in São Paulo, Brazil, participated in this study. They were randomized to 1 of 2 groups: Group I received a stretch program, and group II received a stretch program in addition to SMT. Participants in both groups performed the same standardized stretching program. Spinal manipulative therapy to dysfunctional spinal segments was performed on group II only. All golfers performed 3 full-swing maneuvers. Ball range was considered as the average distance for the 3 shots. Treatment was performed after the initial measurement, and the same maneuvers were performed afterward. Each participant repeated these procedures for a 4-week period. Student *t* test, Mann-Whitney nonparametric test, and 1-way analysis of variance for repeated measures with significance level of 5% were used to analyze the study.

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Results: Forty-three golfers completed the protocol. Twenty participants were allocated to group I and 23 to group II. Average age, handicap, and initial swing were comparable. No improvement of full-swing performance was observed during the 4 sessions on group I (stretch only). An improvement was observed at the fourth session of group II (P = .005); when comparing the posttreatment, group II had statistical significance at all phases (P = .003).
Conclusions: Chiropractic SMT in association with muscle stretching may be associated with an improvement of full-swing performance when compared with muscle stretching alone.

Introduction

Participation in sports is a growing social phenomenon that profoundly influences daily life.[1] One's sport of choice is decided according to each participant's profile, matching one's affinity, desire, facility, and viability.[2] There has been a steady growth of chiropractic treatment for various sports for the maintenance of athletes in optimal competitive conditions. Various therapeutic modalities have been used, with an emphasis on spinal manipulative therapy (SMT). With athletes, chiropractic treatment often aims at increasing performance, rather than treating specific conditions such as pain. It is argued that the maintenance and improvement of joint function, muscle balance, and the speed of neuromuscular reflexes obtained through this treatment may help optimize performance.

Given that SMT is known for pain reduction and enhancing spinal mobility, many professional and high-level amateur golfers in the United States depend on their doctor of chiropractic to prevent them from disorders that may threaten their careers. These athletes want to improve their performance and manage pain in a conservative way and in a short amount of time.[3-11]

Golf sport requires a person to strike a small ball with a club from the teeing ground into a distant hole while following the rules. Golfers may swing the club head as fast as 100 mph in about 0.2 second as they downswing. After they hit the ball, they make a smooth transition from this rapid acceleration to deceleration. To move the golf club going to a high rate of speed, right-handed golfers rotate their knees, hips, trunk, shoulders, and arms clockwise during the backswing, turning away from where they want the ball to go. Afterward, as they unleash their downswing, they quickly uncoil counterclockwise toward the target. In the classic swing, the hips turn about as much as the shoulders. The follow-through ends in more or less a straight up-and-down position. Today's golfers twist more, rotating their shoulders back by as much as 90° and their hips by about 45°. This golf swing puts a higher compressive load on the low back (8 times body weight) than running (3 times) or even rowing (7 times). That is why a single swing can produce a herniated disk or even a compression fracture of one of the vertebral bodies. Although these injuries are extremely painful and can be quite serious, they are rare. Muscle strains, however, are quite common because of the twisting that is required for a good swing.[12-19]

The present study evaluates the effect of SMT on the performance of golf players with a handicap between 0 and 15 during their full swing using a driver club at 2 golf clubs in São Paulo, Brazil.

Methods

A questionnaire was given to associates of 2 golf clubs in São Paulo, Brazil, to those who met the inclusion criteria. The inclusion criteria were as follows: men between 18 and 55 years of age, with a handicap from 0 to 15, practicing golf at least once a week for a 4-hour period. The purpose of the research was clarified; they signed an informed consent and were admitted. Subjects were randomized by lottery to

Table 1 Subject characteristics, according to group studied

Variable	Group	n	Average	SD	Minimum	Maximum	Median	P*
Age	Group I	20	37.15	12.26	23.00	67.00	32.00	.152
	Group II	23	32.13	10.27	18.00	51.00	29.00	
Height	Group I	20	1.72	0.06	1.65	1.85	1.72	.231
	Group II	23	1.75	0.08	1.55	1.90	1.75	

* Descriptive level of Student t test probability.

Table 2 Average value, SD, minimum, maximum, and median of handicap, according to the studied group

Variable	Group	n	Average	SD	Minimum	Maximum	Median	*P* *
Handicap	Group I	20	11.95	3.52	0.00	15.00	13.00	.104
	Group II	23	8.17	6.27	0.00	15.00	10.00	

* Mann-Whitney nonparametric test probability descriptive level.

1 of 2 groups: Group I was a stretch program, and group II included the stretch program and SMT.

Before initiation, this study was approved by the Ethics Board of the Anhembi Morumbi University. The study was performed at both clubs after the associates' training time on the driving range so as not to interfere with regular club activities. The driving range contained noticeable spots at every 50 yd (45.5 m) until 250 yd (227.5 m).

A standardized stretching program was given under supervision of a chiropractor to participants of both groups. Static stretches were performed for 20 seconds bilaterally and included the forearm flexors, deltoids, brachioradialii, biceps, forearm extensors, levator scapulae, gastrocnemii, soleii, quadriceps, hamstrings, and gluteal muscles. Afterward, each golf player was evaluated for the presence of low-back, thoracic, and neck joint dysfunction. Spinal manipulative therapy on dysfunctional segments was performed by a doctor of chiropractic on participants of group II only.

Before each treatment, the participant executed 3 full-swing maneuvers with his driver club, using appropriate gloves at the auxiliary hand, proper shoes, a 7-cm tee, and standardized balls that were provided by the club. Each trial distance was measured by the authors with a 100-m tape measure and transmitted simultaneously via a communicator to an assistant who would remain with the golf player guiding him throughout this process. This assistant would write down the information on an outcome chart. Full-swing ball range was considered as the average distance of the 3 trials. Treatment was performed on all participants after the initial measurement. After treatment, the subjects repeated the same maneuvers. Each participant repeated this sequence of procedures once a week, completing 4 treatments.

Statistics

Initially, all variables were analyzed descriptively. For all quantitative variables, this analysis was done through the observation of minimum and maximum values, and by the average calculus and standard detour (SD). For qualitative variable, the relative and absolute frequency was calculated.[20,21] For the hypothesis of equality analysis between 2 groups, the Student *t* or Mann-Whitney nonparametric test was used when normality supposition of data was rejected. One-way analysis of variance (ANOVA) for repeated measures was used to compare each group before/after

Table 3 Average value, SD, minimum, maximum, and median of distance at the 4 pre-/posttreatment moments, according to the studied group

Group	Moment	Treatment	n	Average	SD	Min	Max	Median
Group I	1	Pre	20	205.35	25.38	149.00	267.00	208.00
		Post	20	204.35	23.87	171.00	276.00	206.00
	2	Pre	20	210.20	24.69	180.00	282.00	208.00
		Post	20	201.75	27.57	162.00	257.00	197.50
	3	Pre	20	208.60	25.12	152.00	256.00	211.00
		Post	20	208.50	25.43	154.00	262.00	211.50
	4	Pre	20	211.75	21.25	177.00	263.00	211.00
		Post	20	212.20	22.93	175.00	265.00	219.50
Group II	1	Pre	23	219.36	40.19	104.00	292.00	221.00
		Post	23	228.18	22.95	188.00	282.00	235.00
	2	Pre	23	226.85	27.66	180.00	285.00	230.00
		Post	23	229.44	31.29	164.00	300.00	230.00
	3	Pre	23	231.12	25.96	185.00	295.00	232.00
		Post	23	235.41	25.10	184.00	305.00	235.00
	4	Pre	23	228.08	25.39	189.00	301.00	230.00
		Post	23	236.26	23.76	196.00	306.00	238.00

Table 4 Comparison of group I and II at the pre-/posttreatment phase

Moment	1	2	3	4
*P**	0.380	0.233	0.245	0.021

* One-way ANOVA for repeated measures.

evaluation moment. The significance level of 5% was used for tests.[20,21]

Results

Forty-three subjects were admitted from February to April 2006. All subjects completed the 4 sessions that comprised the protocol. Twenty participants were allocated to group I and 23 to group II. Average age, handicap, and initial swing at each group were comparable, as follows: age—I, 37.15; II, 32.1 (Table 1); handicap—I, 11.95; II, 8.17 (Table 2); initial swing—I, 205 m; II: 219 m (Table 3).

Group II demonstrated values significantly greater at all evaluation moments ($P = .003$), just not presenting this characteristic at the first pretreatment moment where both groups showed no significant difference (Student t test, $P = .187$). There was a significant alteration at the treatment moments in both groups ($P = .025$). Comparing the behavior, no significant alteration was noticed (Table 3) when using the variation of analysis ($P = .174$).

When comparing both groups during the pre-/posttreatment moment, there was a significant difference between groups at the fourth evaluation as seen in Table 4 (.021), whereas no significance difference was present for the other moments. Examining separately for the pre-/posttreatment, no significant variation was noticed during pretreatment (Table 5), whereas a significant variation was seen on posttreatment. There was a significant increase at the following evaluations: 1 × 4, 2 × 3, and 2 × 4, although other comparisons revealed no significant difference (Table 6).

An improvement on the average of the full-swing performance was observed at each treatment day on group II (stretch + SMT), with statistical significance achieved on the fourth and last day only ($P = .005$, Fig 1). Fig 2 compares the first and fourth day before and after chiropractic treatment, showing a positive difference on the performance in both days; but this is not statistically significant.

Table 5 Comparison of group I and II during the pretreatment moment

Moment	1 × 2	1 × 3	1 × 4	2 × 3	2 × 4	3 × 4
*P**	0.122	0.082	0.089	0.591	0.584	1.000

* One-way ANOVA for repeated measures.

Table 6 Comparison of group I and II during the posttreatment moment

Moment	1 × 2	1 × 3	1 × 4	2 × 3	2 × 4	3 × 4
*P**	0.868	0.103	0.015	0.034	0.014	0.351

* One-way ANOVA for repeated measures.

No improvement of the full-swing performance was observed on group I (stretch) during the 4 days, as shown on Fig 3. At the second day of procedure, there was a decrease on the performance after treatment ($P = .04$). Fig 4 compares the first and fourth day before and after the stretching program, showing a slight difference on the performance in both days, although without statistical significance.

Discussion

This study assembled homogeneous groups as demonstrated on Tables 1 and 2, providing to the present research a credible population with the same characteristics. By observing Fig 1, each day had an improvement on the ball's scope. Furthermore, the increase of performance on the fourth day of treatment was statistically significant ($P = .005$), according to the Student t test. The same graph demonstrates a golfer's performance improvement on group II, despite being without statistical significance. Another notable factor is the medium error value on the swing distance at each day, as intake had a big difference during pre-/posttreatment. This value possibly became stable on the other days because of a cumulative factor. When comparing the first and the fourth day before SMT and stretching, an improvement of the distance was

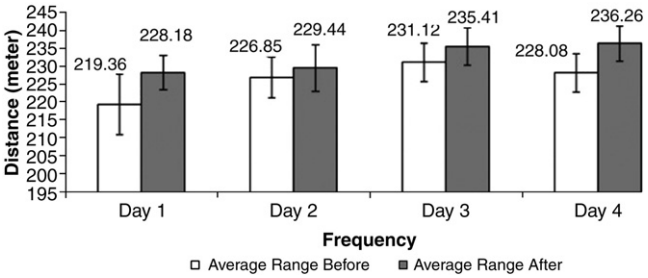

Fig 1. Average range reached by the ball of the SMT + stretching group pre-/posttreatment for the 4 session periods using the Student t test.

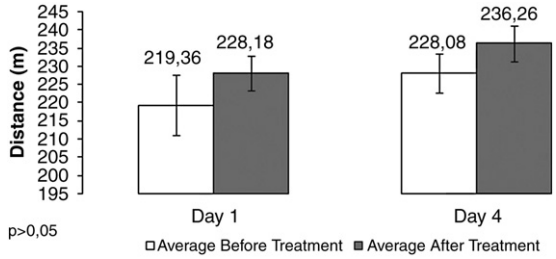

Fig 2. Mean comparison of the distance of the full-swing ball driver on the first and last day on group II.

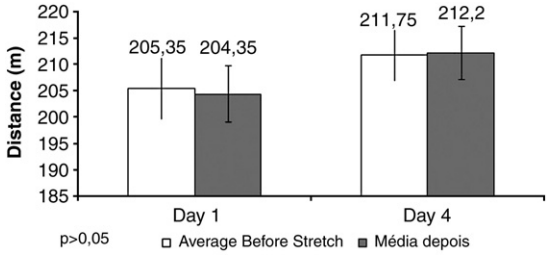

Fig 4. Mean distance comparison on the full-swing driver club on the first and fourth day at group I.

observed, but without statistical significance. The same happened with posttreatment (Fig 2).

Analyzing group I alone through the Student *t* test, Fig 3 demonstrates no significant improvement on the full-swing performance. A statistical significance was seen on the second day of treatment; and it had a negative characteristic because it presented a decrease of the general rate by 9 m, whereas on the other days, this significance was not seen (Fig 3). Therefore, the stretching program alone was not efficient on the full swing using the driver club. Outcomes were inconsistent and had no cumulative characteristics. When comparing the first and the fourth day before stretching, an improvement of the distance was observed, but without any significance. The same happened with posttreatment (Fig 4).

Further analyzing the pre-/posttreatment measurements of group I compared with group II using the 1-way ANOVA for repeated measures, SMT combined with a stretching program contributes to a performance increase on the fourth session ($P = .021$) demonstrated in Table 4. When observing separately the pre-/posttreatment moments, no significant difference was noticed during the pretreatment phase (Table 5); but a significant performance increase was noted during the posttreatment phase at different moments (Table 6). Subsequently, SMT combined with a stretching program promoted an increase of player performance that, throughout the research, had a gradual improvement.

This research had a specific focus in verifying golfers' performance with a driver club during pre-/posttreatments discussed above. The present study offers a pioneer approach involving chiropractic treatment and golf performance with the driver club. Pain was not evaluated, although its potential importance is recognized, opening thus new fields for analysis.

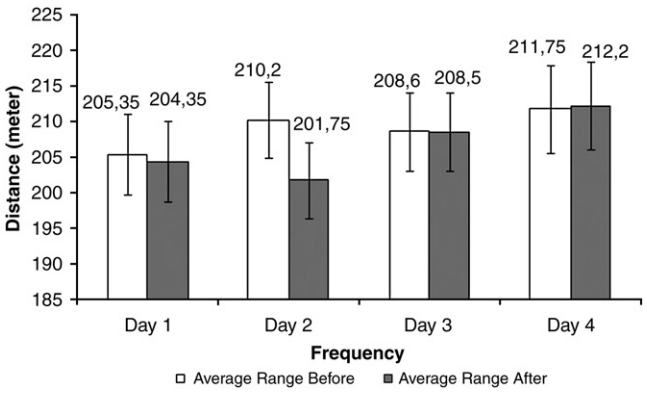

Fig 3. Average range of the distance reached by the ball of the stretching group through the 4 during the pre-/posttreatment session periods using Student *t* test.

Limitations

The limitations of this study are that the number of subjects in each group was small and that the subjects may not necessarily be representative of golfers elsewhere. Not all variables could be accounted for; it is possible that other unknown factors may have had an impact on golfing performance. Larger studies should be completed before extrapolation of findings to other groups of golfers can be made.

Conclusions

Spinal manipulative therapy in association with muscle stretching seems to be associated with an improvement of golf players' full-swing performance when compared with muscle stretching alone.

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