

THE EFFECTS OF LUMBAR SPINE MANIPULATION VERSUS LOWER EXTREMITY MANIPULATION ON AGILITY IN ASYMPTOMATIC ATHLETES

ABSTRACT

Purpose: The purpose of this study was to determine the most effective method of pre-event treatment for asymptomatic patients through comparing lumbar spine manipulation, lower extremity manipulation and a combination of both on the effect of explosive power and agility, as a measure of improvement.

Method: Thirty asymptomatic athletes of moderate to high activity, indicated by the International Physical Activity Questionnaire (IPAQ) participated in this study. Participants were randomly allocated into three equal groups. Group 1 received lumbar spine and pelvis manipulation. Group 2 received lower limb manipulation only and Group 3 received a combination of lumbar spine, pelvis and lower extremity manipulation. Participants had to meet the inclusion and exclusion criteria to be part of the study.

Procedure: The study consisted of six consultations over a three week period, with intervention on every consultation and objective data obtained before and after intervention. The intervention period consisted of motion palpation of the specific groups' regions and manipulative therapy of the findings in each region.

Results: All three groups showed improvements in jump height, jump pressure output and the Illinois test. Group 1 showed an average increase in jump height of 3.26 cm, 2.5 Pa average increase in pressure output and 1.32 seconds average increase for the run of the Illinois test. Group 2 showed an average increase in jump height of 3.10 cm, 1.7 Pa average increase in pressure output and 1.03 second average increase for the run of the Illinois test. Group 3 showed an average increase in jump height of 3.09 cm, 2.8 Pa average increase in pressure output and 1.86 second average increase for the run of the Illinois test. Analysis done on the immediate effect of Chiropractic Manipulative Therapy (CMT) on the hang time during the vertical jump test, displayed an overall statistically significant effect 33 %. Although some effect was achieved, the intervention had no constant improvement on the jump hang time. The minor result was attributed to the small changes in readings.

Conclusion: Although results obtained were not statistically significant ($p>0.05$), it demonstrated from a clinical perspective that interventions caused an improvement in jump height, jump pressure output and the Illinois tests' time in all three groups. Group 3 showed a greater improvement in every aspect, despite being the group with the least demographical advantage. Group 1 had the second best results.

It was thus then postulated that the best method for pre-event treatment is a CMT protocol that effects both the biomechanical and neurological components that has a negative influence on performance. Although some improvements were noted, the results were not conclusive and more research is needed.

Key Words:

- Agility
- Explosive power
- **CMT:** Chiropractic manipulative therapy
- **IPAQ:** International physical activity questionnaire
- Pre-event treatment

INTRODUCTION

Dr. Andrew Klein the official Chiropractor for the 2000 United States Olympic team, stated that: "Athletes have come to rely on manual therapy because the list of banned substances is so long, and also because they feel it enhances their performance" (Medscape news, 2000; Brolinson, Smolka, Rogers, Sukpraput, Gofort, Tilley and Doolan, 2012).

Manipulative treatment has been provided as standard care to athletes at the Olympic Games and other major international multisport games. Pre-competition manipulation may help enhance musculoskeletal function by warming up soft tissues to optimize joint function (Brolinson, et al. 2012).

A scientific study done by Ernst (2003), suggested that by removing spinal fixations, CMT improves maximum voluntary erector spinae muscle power output, shown via electromyography (EMG). Dishman, Ball and Burke (2002), stated that CMT increases motor neural pool excitability for 20 - 60 seconds (s) which can be beneficial to performance.

In a study done on Virginia Tech footballers by Brolinson et al. (2012), found that pre-competition manipulative treatment was positively associated with improved performance among both offensive and defensive Virginia Tech football players. The associations between these two factors were relatively small and not statistically significant and needed more research.

These studies and various others that will be discussed through the course of this study, suggest that CMT has a positive influence on performance. When looking at the effect that CMT has on the biomechanical and neurological components in athletes, the inclusion of chiropractors within top sporting teams' medical staff is a necessity.

MATERIALS AND METHODS

Selection Criteria

Thirty asymptomatic athletes, of moderate to high physical activity training levels, as indicated by the International Physical Activity Questionnaire (IPAQ), participated in this study. Participants were randomly allocated into three equal groups.

The groups consisted of:

- Group 1 (the control group) received lumbar spine and pelvis manipulation only.
- Group 2 received lower limb manipulation only.
- Group 3 received a combination of lumbar spine, pelvis and lower extremity manipulations.

Participants had to meet the inclusion criteria to be part of the study.

Inclusion criteria

- Athletes of any gender between the ages of 18 and 45 (reached athletic maturity).
- Athletes who are asymptomatic with lumbar and or sacral dysfunction (subluxation).
- Athletes who are asymptomatic with lower extremities dysfunction (subluxation).
- Completion of demographic data sheet and signing of the participant information and consent forms.
- Athletes with a moderate to high activity score level according to the IPAQ

Exclusion criteria

- Participants that demonstrate any contra-indications to CMT
- Any history of lumbar spine or lower extremity surgery
- Current Musculoskeletal injury or illness
- Participants that meets a score lower than moderate to high on the IPAQ

Methodology

Consultation procedure

Each participant was treated twice a week, over a period of three weeks, for a total of six treatments.

The first consultation included:

- Explanation of the study to the participants
- Completion of the IPAQ
- Signing of the participant consent form and reading of the information form
- Completion of a case history and a pertinent physical examination

Depending on the group, additional regional examinations were done

- Group 1 - lumbar spine and pelvis regional examinations
- Group 2 - hip, knee, ankle and foot regional examinations
- Group 3 – lumbar spine and pelvis, hip, knee, ankle and foot regional examinations

The pre-intervention tests were conducted after a brief time allocated for warm up. Warm up consisted of a 5 min jog followed by hamstring, quadriceps, gastrocnemius and adductor stretches. This warm up routine was designed to target the main muscle groups used in the set of tests that were performed.

The test period consisted of

- Three Vertical Jump tests
- Two Illinois' tests.

The pre-intervention score was obtained from the test performed prior to manipulation. On commencement of pre-intervention score taking, manipulative therapy was conducted, specific to the allocated groups.

The intervention period consisted of motion palpation of the specific group regions and manipulative therapy of the findings in each region.

A second test period was completed after completion of the intervention period. Post-intervention testing consisted of three Vertical Jump tests and two Illinois' tests. The post-intervention score was obtained from the post-intervention test period. Follow-up consultations were similar to that of the initial consultation with regards to pre-intervention, intervention and post-intervention periods.

Consultation consisted of:

- Allocated warm up time
- Pre-intervention testing
- Intervention
- Post-intervention testing.

All testing periods were constant with that of the initial consultation.

RESULTS

Intragroup Analysis

Immediate effect on jump height

Group 1 had an average p-value of 0.02. Group 2 displayed an average p-value of 0.02 and Group 3 had a p-value average of 0.01. This indicated that the intervention had a statistically significant effect on the jump height in all three groups.

Immediate effect on jump hang time

Analysis of the immediate effect of CMT on the hang time of the Vertical Jump test, displayed that a statistically significant effect was noted in 33% of the results. The results were abnormally distributed between groups, thus indicating a non-statistically significant influence of the intervention. Group 1 had an average p-value of 0.06. Group 2 displayed a p-value average of 0.14 and group 3 had a p-value average of 0.06.

Immediate effect on jump pressure output

A statistically significant effect was achieved in 66 % of the results. The statistically significant results were distributed in such a manner that it could be related back to the effect of the intervention (refer to Chapter 4). Group 1 had an average p-value of 0.05. Group 2 displayed an average p-value of 0.07 and Group 3 had a p-value average of 0.04. The results indicated that the two groups that received CMT to the lumbar spine and SIJ (Group 1 and Group 3) had a statistically significant effect.

Immediate effect on Illinois' test

The Illinois' tests' the p-value was consistently less than 0.05, indicating that on all comparisons between groups a statistically significant change was noted. Group 1 had an average p-value of 0.02. Group 2 displayed an average of 0.01 p-value and Group 3 had a p-value average of 0.03.

The results obtained from the Repeated Measure ANOVA test on the effectiveness of CMT, clearly showed an immediate improvement on most aspects of the tests. However this could be attributed to either one of the plausible theories that CMT increases performance physiologically or just decreases the frustration levels of the athlete. More investigation on this matter is needed.

Intergroup Analysis

The Inter-group analysis showed none of the findings from the One-way ANOVA-All test was statistically significant. In obtaining mean values for clinical significance through simplistic calculation of results, statistical information was lost and thus had no statistical significance, but important indications for enhancing pre-event performance.

Within all three groups, improvements were made in jump height, jump pressure output and the Illinois' test. Group 1 showed an average increase in jump height of 3.26 cm, 2.5 Pa average increase in pressure output and 1.32 s average increase in the Illinois' test.

Group 2 showed an average increase in jump height of 3.10 cm, 1.7 Pa average increase in pressure output and 1.03 s average increase in the Illinois' test.

Group 3 showed an average increase in jump height of 3.09 cm, 2.8 Pa average increase in pressure output and 1.86 s average increase in the Illinois' test.

DISCUSSION

The Vertical Jump test and Illinois' test were described by Carmelo, Pekka and Paavo (2003), to be a valid and reliable way to test an athlete's performance. An increased reaction time between opponents is usually the difference between winning and losing (Baechle and Earle, 2002). A statistically significant immediate result for an athlete could yield drastic improvements on the sporting field.

Before participants took part in this study, they were informed about the procedures, protocols and potential benefits. A baseline measurement was taken at the first consultation to prevent the potential influence of the learned response. This, however could not be totally prevented throughout the six consultation time period.

All three test groups showed an increase in most variables, with the small margins of the jump hang time being the only variable to show unreliable results. Group 3, who received CMT to all the joints from the lumbar spine, the SIJ, the hip, the knee and the foot and ankle, outperformed the other groups.

Clinical significance was obtained through interpreting of the mean values of the variables from the Vertical Jump test and Illinois' test. The immediate effect of the intervention showed best results for the group who received a combination of lumbar spine, SIJ and lower limb CMT. All three groups had a positive result after CMT. On comparing the pre- and post-intervention results, Group 1 had an average increase in jump height of 3.26 cm, 2.5 Pa average increase in pressure output and 1.32 s average increase the Illinois' test. Group 2 showed an average increase in jump height of 3.10 cm, 1.7 Pa average increase in pressure output and 1.03 s average increase the Illinois' test. Group 3 showed an average increase in jump height of 3.09 cm, 2.8 Pa average increase in pressure output and 1.86 s average increase in the Illinois' test.

Out of the study that consisted of thirty participants, all of moderate to high activity levels indicated by the IPAQ, only one participant had previously performed the tests. This small margin allowed optimal inter-group comparison. As mentioned previously, the two groups (Group 1 and Group 3) who received CMT to the lumbar spine and SIJ showed better results than Group 2, who didn't. According to previous studies conducted by Shrier, Macdonald and Uchacz. (2006), showed that a combination of neurological and biomechanical influence, yields best results on performance.

The results obtained from this study suggested that the participants who had both neurological and biomechanical components had dampened performance. The groups that had both the neurological and biomechanical components of dysfunctions addressed and altered by CMT, had a more positive effect.

CONCLUSION

The aim of this study was to find the most effective method of pre-event treatment for asymptomatic patients through comparing lumbar spine manipulation, lower extremity manipulation and a combination of both, on the effect of explosive power and agility, as a measure of improvement.

The immediate effect of intervention proved to be clinically beneficial for all three groups, with the exception of the vertical jump hang time. This was attributed to the small changes in the readings. This in statistical analysis was rendered as a non-effect.

The study proved to be beneficial over a short period of time, but only for a few factors of the tests conducted. Statistically significant improvements were seen in the Vertical Jump test's height and pressure output variables. Although found not to be statistically significant, the Illinois' test had a positive average improvement of 0.67 s (6 %) in Group 1. Group 2 improved with 0.72 s (8 %) and Group 3 had a 0.98 s (9 %) improvement.

This immediate increase in performance for athletes who compete in millisecond to get the edge over their opponents should be very beneficial. The short term effect affected two factors of the Vertical Jump test more than the rest. Group 3 showed the best improvement over time.

This research thus proved that the best method for pre-event treatment is a CMT protocol that effects both the biomechanical and neurological components that has a negative influence on performance. Although some improvements were noted, the results were not conclusive and more research is needed. The benefit of this study was then to prove, once again, that CMT has a positive effect on performance related to muscle strength, the power generated in a short burst and the agility of athletes. It also served to lay down some ground work for proving the importance of chiropractors as part of any top performing athletes' medical team.

ACKNOWLEDGMENTS

This study was funded by the University of Johannesburg.

Dr I. Landman: Supervisor.

This study was conducted in association with the University of Johannesburg's Bio-kinetics department. Statistical analysis was done by STATCON.

REFERENCES

- Baechle, T.R. and Earle, R.W. (2000). Essentials of Strength training and conditioning. 2nd edition. Champaign Illinois': Human Kinetics. pp.293, 298.
- Brolinson, G.P., DO; Smolka M., DO; Rogers M., DO, MA; Sukpraput S., PhD, MA, MSc; Goforth M.W., MS, ATC; Tilley G., DC; and Doolan K.P., MS, ATC. (2012). JAOA. Precompetition Manipulative Treatment and Performance Among Virginia Tech Athletes During 2 Consecutive Football Seasons: A Preliminary, Retrospective Report. 112 (1), 1-16.
- Carmelo B., Pekka L., and Paavo V.K. (2003). A Simple Method for Measurement of Mechanical Power in Jumping. European Journal of Applied Physiology. (1983) 50:273-282.
- Dishman, J.D., Ball, K.A. and Burke, J, (2002). Central motor excitability changes after spinal manipulation: a transcranial magnetic stimulation study. Journal of Manipulative and Physiological Therapeutics, (25):1-9
- Ernst, E. (2003). Chiropractic spinal manipulation for back pain. British journal of sports medicine, (37):195-196.
- International physical activity questionnaire. (2005). Guidelines for data processing and analysis of the international physical activity questionnaire (IPAC). Available from: <http://www.ipac.ki.se/downloads.htm>.
- Medscape news. (2000). Chiropractic care supports Olympic athletes. Available from: <http://www.medscape.com/viewarticle/412128>. (Accessed 21 June 2015).
- Shrier, I., Macdonald, D. and Uchacz, G. (2006). A Pilot study on the effects of pre-event manipulation on jump height and running velocity. British Journal of Sport Medicine, (40):947-949.