ORIGINAL ARTICLE

CONCORDANCE IN THE RESULTS OF THE TEST LEG LENGTH INEQUALITY IN AGROUP OF CHIROPRACTORS AFTER A TRAINING.

Joaquín Ignacio Farías Becerra[1] Marcel Alejandro Miranda Guzmán[2]

SUMMARY

Introduction: The leg length inequality test (LLI) is used within the evaluation procedures of various chiropractic methods; however, the results of a training process for a group of Chiropractors in relation to the concordance of results obtained have not been identified.

Objective: To investigate the concordance in the results of the LLI test in prone position, after a training on this evaluative procedure to a group of Chiropractors.

Methodology: 57 chiropractors attending an international certification program of the Thompson chiropractic method of the J. Clay Thompson Foundation were recruited to participate in this study, which was conducted in 3 stages. Chiropractors or examiners were required to record the result of the evaluation of a standardized subject prior to and after training in the evaluation procedure. Examiners were blinded to individual and inter-examiner results. The McNemar test was chosen for the analysis of the collected data.

Results: The statistical analysis with the McNemar test reveals a significant change (p < 0.01) in the concordance of the results obtained between the measurements before and after training.

Conclusion: This study reveals a highly significant change in the concordance of prone LLI test scores in a group of chiropractors following training in the evaluation process.

Keywords: Leg length inequality; Chiropractic; Observer Variation; Reproducibility; Physical exam.

INTRODUCTION

Since the origins of Chiropractic in 1895, the profession has developed different evaluative systems to analyze the relationship between the spine and the nervous system, among these analyzes are included: Radiography, thermography, static and dynamic palpation, postural evaluation, indicators of the autonomic nervous system, the measurement of the inequality in the length of the legs, among others.[1]

Currently, various health care disciplines, including chiropractic, medicine, physiotherapy, podiatry, and obstetrics consider the leg length measurement as an evaluation test with different purposes, significance and validity.[2]

LLI is generally categorized as either anatomical or functional. Anatomically based LLI is the result of congenital or acquired deformities and represents an actual bony asymmetry that exists somewhere between the femoral head and the calcaneus.

Possible causes of anatomic LLI include infectious or congenital disorders, neoplasms, trauma, radiation, muscle paralysis, degenerative changes, and abnormal growth patterns. [3] Functional LLI is a more complex phenomenon in which the observed change in length is believed to be the result of various physiological adaptations due to biomechanical abnormalities along the kinetic chain, such as the presence of vertebral misalignment. [2,4,5] This altered neuromuscular adaptation or normal function has been identified as one of the characteristics of chiropractic subluxation, and its analysis through LLI is useful in the evaluation of different body functions: such as gait, locomotion, weight-bearing and posture.[6]

Several models of chiropractic analysis based on vertebral subluxation incorporate the LLI test, in which the Chiropractor seeks to determine the presence of a functional asymmetry of the lower extremities, as a result of a neuro-biomechanical adaptation due to one or more vertebral subluxations located

in the axial skeleton of individuals. [7,8,9,10]

There are numerous methods for assessing LLI. The 3 most used analytical methods are radiographic examination, orthopedic devices (including the basic tape measure), and visual assessment of leg length in the prone or supine position. The choice of which method to use depends on the type of LLI the Doctor is evaluating.[11]

The Derifield-Thompson LLI test was first published in the Thompson Technique Reference Manual in 1984. [12] Within the evaluative procedure described in this manual, a first position or position one is mentioned to determine the LLI, this procedure consists of positioning a person in prone decubitus on the chiropractic table and take the ankle-foot complex. Subsequently, the examiner observes the length of the lower extremities to determine the presence or not of a "shortened lower extremity", which, added to other evaluative procedures, could indicate the location of the subluxations present in the axial skeleton of the person evaluated.

Although previous studies have found good inter-examiner reliability with respect to the LLI test in prone position [4,5,13,14] There is no published research evaluating the impact on the results obtained in this assessment procedure after official training in a group of Chiropractors.

In this study, the authors evaluated the effect of a prone LLI test training on a group of 56 chiropractors. The results of this research may be considered important to determine the methodology and results in the teaching of these evaluative procedures in the curriculum of universities and/or chiropractic methods that use it.

The results of this study can determine the importance of training oriented and focused on achieving homogeneity in the application of this evaluative procedure by Chiropractors, in order to achieve a good degree of inter-examiner reliability.

METHODOLOGY
The data was collected on two occasions during the international certification of the Thompson method in Chile, one was carried out in the city of Puerto Varas and the second in Santiago. The establishments where the research was carried out were configured with similar characteristics on both occasions, they were separated into three environments: waiting room, an evaluation room, and an exit room. The evaluation environment had a chair, a chiropractic table, a record sheet and a mailbox to put the answer.

Participants
Two volunteers per group (4) were invited to participate in this study, one participant for the pre-training measurement and one for the post-training measurement. To be included, participants had to: 1. Be over 18 years of age; 2. Be able to be in prone position during the evaluation process; 3. Have an* LLI between 5 mm to 15 mm; 4. Agree to participate in this study. Exclusion criteria included: 1. Having any red flag that prevents participation; 2. Being under treatment with medications that alter muscle tone; 3. Receiving chiropractic adjustments in a period less than 7 days. Standardization of the participant was necessary so that the study subject did not differ between the two groups. Exclusion of the participant for receiving chiropractic adjustments in a period of less than seven days was determined by pilot tests that revealed an

increase in the variability of the LLI in this type of participants.[13]

Participants were instructed on the procedure prior to their participation. On the day of data collection, the informed consent was signed, and then the difference in LLI was measured in the participant with a digital meter foot to obtain the necessary metric to meet the inclusion criteria.

The participant was escorted to the evaluation room and asked to sit in a chair next to the chiropractic table. The participant was asked to remain dressed as they arrived, to include "participant preparation" by the examiner, as part of the LLI evaluation process. After an evaluation process, the participant had to dress again in preparation for the evaluation of the next examiner.

Examiners
Fifty-six Chiropractors were the examiners in this study. To be included in this study, examiners were required to: 1. Be College Chiropractors (54) with different years of professional experience or college chiropractic students (2); 2. Be participants in the certification program; 3. Sign informed consent of their participation for the study. Exclusion of examiners included not being present at any of the stages of the research.

Experimental Procedure
The research days were divided into 3 stages:

Stage 1. In this stage of the study, the group of chiropractic examiners conducted the first collection of data obtained from the evaluative procedure on a test subject.

The examiners were instructed on the procedure in data collection. All the examiners started in the waiting room; one by one they were called randomly to enter the evaluation room in order to perform the LLI evaluation of the participant. After the evaluation, the examiners had to record their finding by marking on the recording sheet an X on one of the three possible results of the evaluation: 1. Short left lower extremity; 2. Short right lower extremity; 3. Equal lower extremities. After the recording, they folded the recording sheet in four and deposited it in a closed mailbox, then retreated to the exit room and waited there until all the examiners finished the data recording.

Stage 2. In this stage, the group of chiropractic examiners received a 10-hour theoretical-practical pedagogical training on the evaluation procedure for two days. The training was conducted by two international Thompson Method instructors from the J. Clay Thompson Foundation.

The training consisted of theoretical-practical modalities, both group and personalized for each examiner, which included preparation of the participant for the procedure, positioning of the participant on the chiropractic table, contact points on the participant's ankle-foot segment, contact points on the examiner's hands, segment correction, pressure points and axes of the assessment procedure.

Stage 3. At this stage of the study, the group of chiropractic examiners conducted the second collection of data obtained from the evaluative procedure on a test subject after the training performed.

RESULTS

In order to establish significant differences between the concordance of results before and after the training performed, a biostatistician independent of the study applied the McNemar test.

Below are the tables of the results obtained by the Chiropractors of Group 1 and Group 2, from the data collection of Stages 1 and 3.

Group 1 (31 Chiropractors)

Table 1. Results obtained in the evaluation procedure of Stage 1 - Group 1.

	Right short leg	Left short leg	Equal legs
Total	21	10	0
Percentage	67,7 %	33,3%	0%

Table 2. Results obtained in the evaluation procedure of Stage 3 - Group 1.

	Right short leg	Left short leg	Equal legs
Total	31	0	0
Percentage	100 %	0%	0%

Group 2 (25 Chiropractors)

Table 3. Results obtained in the evaluation procedure of Stage 1 - Group 2.

	Right short leg	Left short leg	Equal legs
Total	14	9	2
Percentage	56 %	36%	8%

Table 4. Results obtained in the evaluation procedure of Stage 3 - Group 2.

	Right short leg	Left short leg	Equal legs
Total	23	2	0
Percentage	92 %	8%	0%

After the analysis of the data collected in the study, the contingency table of the McNemar test is as follows:

Table 5. Results of the statistical analysis using McNemar.

Contingency table Start * End				
Start		**End**		
		Right	Left or equal	**TOTAL**
Right	n	35	0	35
	%	100,0%	0%	100,0%
Left or equal	n	19	2	21
	%	90,5%	9,5%	100,0%
Total	n	54	2	56
	%	96,4%	3,6%	100,0%

Since the short right lower extremity was considered the correct option, a variable was created with this option. The second variable included the incorrect options of the assessment procedure.

It is determined that there is a highly significant change of 0.000036 ($p < 0.01$) between the concordance of data collected by the examinations, comparing the collection of Stage 1 and Stage 3.

DISCUSSION

In this study, it was possible to determine a highly significant improvement in the concordance of the results of the LLI assessment procedure by the 56 chiropractic examiners after training. That is, the training generated a significant change. This result is consistent with a previous study by Kelly R. Holt et al., which revealed good inter-examiner reliability, when two examiners were used, one of whom was an experienced Chiropractor and the other an undergraduate Chiropractic student who was intensively trained on the LLI test a couple of weeks prior to performing the evaluations on a group of patients.[13]

Other previous studies have used only experienced professionals as assessors; Fuhr and Osterbauer reported good inter-examiner reliability with a good κ value (0.31-0.75) on the test, when performed with the patient lying prone with knees extended.[14]

Schneider et al., found a concordance percentage of 82% with a κ = 0.65 when evaluating a group of patients in prone decubitus with knees extended. [5]

Nguyen et al., also investigated the reliability in the leg check performed on patients lying prone with knees extended and reported an inter-examiner percentage agreement for the short leg side of 85% with a κ of 0.66. [4]

The results obtained in this study suggest that a prone LLI test training protocol can significantly improve post-training inter-examiner agreement of the results and have an impact on inter-examiner reliability.

These results are of great educational interest when determining the number of teaching hours that the methods use to teach these assessment procedures as part of their protocols. Likewise, it is interesting that specific training of a group of chiropractors is needed for this evaluative procedure to have greater concordance and reliability. This implies that the evaluative procedure must be performed in a correct manner to obtain the proper analysis in the chiropractic evaluation.

LIMITATIONS

Although there was no exclusion criteria in the test subjects that included the presence of any type of symptomatology, the selected test subjects did not have an active clinical picture at the time of the study. Recommendations from other studies suggest having test subjects with some symptoms present. [15] This study did not attempt to analyze the validity or clinical relevance of the LLI test in prone position.

CONCLUSION

This study revealed that a formal training of 10 pedagogical hours to a group of chiropractors in the use of the LLI test in prone position, achieves a highly significant change in the concordance of data collection obtained.

CORRESPONDANCE AUTHOR

Joaquín Ignacio Farías Becerra
Maipú 187 of 38, Valdivia –Chile
fariasjoaquin@gmail.com +56963644371.

ACKNOWLEDGMENTS

REFERENCES CITED

1. Valdivia J. Leg Length Inequality as a Chiropractic Metric: a Historical Approach. Chiropractic History. Volume 37, No.1. Pag. 42-50).

2. Mannello DM. (1992) Leg length inequality. J Manipulative Physiol Ther 15:576- 90.

3. Giles LGF, Taylor JR. Low-back pain associated with leg length inequality. Spine 1981;6:510-21) (Reid DC, Smith B. Leg length inequality: review of etiology and management. Physiother Can 1984;36:177-82.

4. Nguyen HT, Resnick DN, Caldwell SG, Elston Jr EW, Bishop BB, Steinhouser JB, et al. Interexaminer reliability of activator methods' relative leg-length evaluation in the prone extended position. J Manipulative Physiol Ther 1999;22:565-9.

5. Schneider M, Homonai R, Moreland B, Delitto A. Interexaminer reliability of the prone leg length analysis procedure. J Manipulative Physiol Ther 2007;30:514-21.

6. Fuhr A.W., Green r.n.,Keller, T. S., Colloca C. J (1997) Activator Methods Chiropractic Technique. Mosby 1e January 15.

7. Ebrall P, Nest A, Walker L, Wright D. Palpatory literacy and the subluxation complex: developing a model to represent what we think and feel. Chiropr J Aust 2006;36:127-36

8. Henderson CN, Cramer GD, Zhang Q, DeVocht JW, Fournier JT. Introducing the external link model for studying spine fixation and misalignment: part 1—need, rationale, and applications. J Manipulative Physiol Ther 2007;30: 239- 45.

9. Owens EF, Pennacchio VS. Operational definitions of vertebral subluxation: a case study. Top Clin Chiropr 2001;8:40-8.

10. Owens E. Chiropractic subluxation assessment: what the research tells us. J Can Chiropr Assoc 2002;46:215-20.

11. Holt KR, Russell DG, Hoffmann NJ, Bruce BI, Bushell PM, Taylor HH. Interexaminer reliability of a leg length analysis procedure among novice and experienced practitioners. J Manipulative Physiol Ther. 2009 Mar- Apr;32(3):216-22. doi: 10.1016/j.jmpt.2009.02.009. PMID: 19362232.)

12. Thompson JC. Thompson technique reference manual. Elgin (IL): Thompson Educational Workshops and Williams Manufacturing Inc; 1984. p. 14-34)

13. Kelly R. Holt, BSc (Chiro), PGCertHSc,a David G. Russell, BSc (Chiro),b Nicholas J. Hoffmann, BHIthSci, B Chiro,c Benjamin I. Bruce, B Chiro,d Paul M. Bushell, B Chiro,e and Heidi Haavik Taylor, BSc (Chiro), PhD. Interexaminer reliability of a leg length analysis procedure among novice and experienced practitioners. J Manipulative Physiol Ther. 2009 Mar- Apr;32(3):216-22. doi: 10.1016/j.jmpt.2009.02.009. PMID: 19362232.)

14. Fuhr AW, Osterbauer PJ. Interexaminer reliability of relative leg-length evaluations in the prone, extended position. J Chiropr Tech 1989:13-8.

15. Haas M. Statistical methodology for reliability studies. J Manipulative Physiol Ther 1991;14:119-32.

TABLES

Table 1. Results obtained in the evaluation procedure of Stage 1 - Group 1.

	Right short leg	Left short leg	Equal legs
Total	21	10	0
Percentage	67,7 %	33,3%	0%

Table 2. Results obtained in the evaluation procedure of Stage 3 - Group 1.

	Right short leg	Left short leg	Equal legs
Total	31	0	0
Percentage	100 %	0%	0%

Table 3. Results obtained in the evaluation procedure of Stage 1 - Group 2.

	Right short leg	Left short leg	Equal legs
Total	14	9	2
Percentage	56 %	36%	8%

Table 4. Results obtained in the evaluation procedure of Stage 3 - Group 2.

	Right short leg	Left short leg	Equal legs
Total	23	2	0
Percentage	92 %	8%	0%

Table 5. Results of the statistical analysis using McNemar.

Contingency table Start * End

Start		End: Right	End: Left or equal	TOTAL
Right	n	35	0	35
	%	100,0%	0%	100,0%
Left or equal	n	19	2	21
	%	90,5%	9,5%	100,0%
Total	n	54	2	56
	%	96,4%	3,6%	100,0%

Since the short right lower extremity was considered the correct option, a variable was created with this option. The second variable included the incorrect options of the assessment procedure.