BILATERAL WEIGHT DIFFERENTIAL AND FUNCTIONAL SHORT LEG:
An Analysis of Pre and Post Data After Reduction of an Atlas Subluxation

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ABSTRACT

Interest in leg length inequality (LLI) has focused on the amount needed to trigger low back problems and the prevalence found in the population. More recent attention deals with LLI and the distribution of weight in either leg. It has been found that the greater weight will shift to the side opposite of the short leg. The present study predicted more parity of weight after an atlas adjustment. Pre and post measurements on 93 subjects were found to be 12.84 lbs. and 3.67 lbs. The contra-lateral weights were greater than the ipsi-lateral weights which is consistent with the previous research.

INTRODUCTION

Both the chiropractic and the medical professions have found leg length inequality (LLI) useful in understanding problems related to the spine. The earlier focus had to do with the prevalence of LLI in the population (Rush & Steiner[1], Stoddard[2], Giles & Taylor[3]) and the extent that LLI caused low back problems (Giles & Taylor[3], Friberg[4], and Seemann[5]).

More contemporary studies have been concerned with weight distribution of the LLI. Lawrence[6] and Vernon & Grice[7] both found that with greater LLI differences, the heavier weights would be found on the contra-lateral side. Lawrence thought the gluteus medius helped level the pelvis if there were large contra-lateral LLI's. Vernon & Grice felt that after time, body weight would shift to the opposite side as a compensatory move which they called the "trochanteric shift".

The research about LLI and weight distribution has been primarily written about the structural short leg, because of the lack of agreement on how to measure a functional short leg.[8] As a consequence, little attention has been given to the effects of an adjustment and LLI. Sherwood et.al.[9] found postural changes after a toggle recoil adjustment to the cervical spine, although no changes were found with the bilateral weight differential.

The purpose of this study was to verify that weight differentials would reduce after an atlas adjustment. Clinical trials had demonstrated this was the case. If there were significant changes it would suggest the patients had a functional short leg.

MATERIALS AND METHODS

Information for the study was taken from the records of a chiropractor who only gave atlas adjustments. The records were taken consecutively from a random starting point. No special treatment or measurement was given to the patient as a requirement of the study. Initially, each patient was given a case history, neuromusculature examination, supine leg check, Anatometer check and if warranted, a series of cervical x-rays which include a lateral, nasium and vertex view. A total of 93 patient's were used.

The primary measuring instrument was the Anatometer II which records body distortion and bilateral weight distribution. See Figure 1. The instrument has two foot plates that are mounted on a platform. A tube approximately four inches in diameter extends from the rear of the platform five feet vertically. The vertical tube holds movable caliper arms which are placed on the crest of the ilium and measure angular displacement both in the frontal and transverse planes. A probe located on the arms measures C-7 relative to a vertical gravital line. These three measurements are recorded in degrees. Transducers located in the foot plates measure bilateral weight distribution of the patient sensitive to 0.10 lb.

Earlier Anatometer studies established the reliability and objectivity of the instrument.[10-11] Although no tests have been made with the transducers, it was determined that other research using some form of scales proved to meet the reliability requirement.

Five pre and post measurements were taken on 93 patients. The post data was taken approximately 6-8 weeks after the initial measurement. This time frame was chosen because patients usually start to stabilize and hold their adjustment during this period. The patient may have received additional adjustments up to the time of the fifth visit. The five measurements taken were the supine leg check, the WD, and the frontal, transverse and fixed point reading from the Anatometer. A total of 930 measurements were taken.

RESULTS

In Table #1 the difference between the pre and post measurement is 9.17 lbs. which is significant. Of note is that one patient carried a 54 lbs WD which reduced to zero after the adjustment. Only three patients had a zero WD on the pre check.

Table #2 shows that not all of the patients had a reduction in WD after the post adjustment period. Eleven percent increased their WD and in that group, some shifted the WD to the opposite side. The post adjustment WD mean was 3.67 lbs. and only eight patients reduced their WD to zero.

Tables #3 and #4 illustrates the percent change for the supine leg check and the Anatometer measurements. In most cases, the leg length reduced to less than 0.125 inch. The pre mean was 0.67 inch and the post mean was 0.17 inch.

With the Anatometer data, the transverse plane had the most residual distortion, which was predictable based on earlier validity studies on the Anatometer.

Tables #5 and #6 confirms the findings of Lawrence[6] and Vernon & Grice[7] that a number of people carry the WD on the side opposite the short leg. Table #6 also confirms that the contra lateral side will carry heavier weights than the ipsi-lateral side.

Table #7 compares five studies that measured the percent of LLI found in the population. Of particular note is that three of the surveys used radiographic methods to determine LLI and two used external instrumentation yet the results were similar with the range spread between 71% - 92%.

DISCUSSION

Using the WD measurement may be more acceptable to researchers not familiar with the upper cervical analysis. There seems to be a basic agreement with the previous research as to the amount of LLI found in the population and that the contra-lateral weight is greater than ipsi-lateral weight. In another area of agreement, Vernon & Grice felt that a 50:50 weight distribution might be ideal but body mass or postural compensation would preclude it happening. In this study, only eight of 93 patients reduced to zero WD. The results of this research should at least persuade the critics that the atlas adjustment caused a weight differential shift.

The findings also raise some questions regarding structural LLI. It has been implied in some of the literature, if an LLI is found using the radiographic method[12], then the LLI is structural. These studies suggest that 70%-90% of the population carry some form of LLI. These high ranges are not being found by the field practitioner. R.R. Gregory[13] treating more than 10,000 cases over a 40 year span felt the incidence of true LLI was less than 5%. Research done in 1978 validated the Gregory hypothesis.

As indicated earlier, Sherwood et al[9] and Seemann[14] identified about the same percentages of LLI as the other studies using the Structural Stress Analyzer and the Anatometer respectively. And though the indexes and WD characteristics are similar, the conclusions are different. Sherwood et.al. found postural changes after a toggle recoil adjustment. With this study, 95% of the patients changed their LLI after an atlas adjustment. One would not expect a high percent of change if the majority of the population are supposed to have a structural LLI. It is the conclusion of this writer that the incidence of structural LLI is greatly overestimated. The reasons are outside the scope of this paper, but the mind-set is to assume a structural LLI if the radiographs determine an obliquity of the femur heads. Even with radiographs, it might be better to assume spastic contracture as a result of an atlas subluxation. A successful atlas adjustment will confirm whether the LLI is structural or functional.

ACKNOWLEDGMENTS

The author wishes to thank Dr. Keith Denton for his help in compiling the data for this study. Also thanks goes to Dr. Teresa Denton and Dr. Michael Thomas for collecting data for the 1991 pilot study.

REFERENCES

1. Rush WA, Steiner HA. A study of lower extremity length inequality. Am J Roentgen. 56:616-623, 1946.

2. Stoddard A. Manual of osteopathic technique. London. Hutchinson Medical Publications, 1959, p212.

3. Giles LFG, Taylor JR. Low back pain associated with leg length inequality. Spine 1983; 8:643-651.

4. Friberg 0. Clinical symptoms and biomechanics of lumbar spine and hip joint in leg length inequality. Spine 1983; 8:643-651

5. Seemann DC. C1 Subluxations, short leg and pelvic distortions. Upper Cervical Monograph, Nov 1978; 2(5) 1-5. Also J of the Australian Chiropractor's Association, 1980. 1(6) 28-32.

6. Lawrence D. Lateralization of weight in the presence of structural short leg: a preliminary report. JMPT 1984; 7(2): 105-107.

7. Vernon H, Grice A. The four quadrant weight scale: a technical and procedural review. JMPT 1984; 7(3): 165-169.

8. Lawrence D. Chiropractic concepts of the short leg: a critical review. JMPT 1985; 8(3): 157-161.

9. Sherwood K, Brickner D, Jennings D et.al. Postural changes after reduction of the atlantal-axial subluxation. J of Chiropractic Research 1989; 5(4) 96-100.

10. Addington EA. Reliability and objectivity of Anatometer, supine leg length test, Thermoscribe II, and Derma-Therma-o-Graph measurements. Upper Cervical Monograph. July 1983; 3(6)

11. Seemann DC. An evaluation of the objectivity and reliability of the Anatometer. Upper Cervical Monograph. January 1984 3(6) 1-3.

12. Rock BA. Short leg a review and survey. J of the Australian Chiropractors Association. Sept. 1988; 18(3): 91-96.

13. Thomas MD. Leg length inequality in the chiropractic and medical literature. The Upper Cervical Monograph. Sept. 1991; 5(2): 12-16.

14. Seemann DC. A comparison of weight differential between a group that had a history of spinal problems or had been under care and a group that had neither a history of spinal problems nor been under care. The Upper Cervical Monograph. Sept. 1991; 5(2): 17-19.

Table 1

Pre and Post Adjustment Weight Differential (WD) Means and SD's of 93 Patients

Group	Mean	SD	N
Pre	12.84 lbs+	8.52	93
Post	3.67 lbs*	3.71	93

* significant p <.01

\+ similar to pilot 12.51 lbs (Seemann[14])

WD Range: pre 54 - 0
post 18 - 0

Table 2

Percent of Patients Whose Weight Differential (WD) Changed Post Adjustment

Status	% Change
Decreased	85%
Increased	11%
No Change	4%

8 patients reduced WD to zero. N=93

Table 3

Percent of Patients Who Changed LLI Post Adjustment Measured by the Supine Leg Check

Leg Check	% Change
Change (reduced)	95%
No Change	5%

N= 93

Table 4

Percent of Patients With Some Residual Distortion Post Adjustment Measured by the Anatometer

Measurement	% Residual
Frontal Plane	14%
Transverse Plane	20%
Fixed Point	5%
Mean Residual Dist.	11%

N= 93

Table 5

The Incidence of Contra-lateral WD and Ipsi-lateral WD Found in Three Different Studies

Study	Contra	Ipsi	N
Lawrence	54%	46%	92
Seemann	41%	59%	93
Vern & Grice	62%	28%	44

Table 6

A Comparison of Pre Adjustment Means and SD's Between Ipsi-lateral WD and Contra lateral WD

Group	Mean	SD	N
Ipsi	12.02 lbs	7.9	55
Contra	14.34 lbs*	9.1	38

* significant p<.01

Table 7

Percent of LLI Found
Over Five Studies, 1946-1991

Study	Year	% LLI
Rush & Steiner*	1946	71%
Friberg*	1983	92%
Lawrence*	1984	80%
Sherwood et al	1989	74%
Seemann	1991	71%

* Radiographic measurement

Figure 1.
Anatometer II (1991)