An Exploration of Zink's Common Compensatory Pattern: Comparing Myofascial Restrictions to Segmental Spinal Somatic Dysfunctions: A Retrospective Study

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ORIGINAL CONTRIBUTION

Abstract

Background

Zink's Common Compensatory Pattern (CCP) is a pattern of somatic dysfunction that can be observed in the spinal transitional zones. The CCP can be described as left/right/left/right rotation in the regions of C0/C1/C2, C7/T1, T12/L1, and L5/S1, respectively. It has been proposed that Zink's pattern can be identified by both myofascial and segmental assessments. This retrospective study investigates myofascial restrictions and spinal somatic dysfunctions to determine whether an agreement exists between myofascial rotation restrictions and osteopathic structural exam findings.

Methods

Osteopathic manipulative medicine (OMM) screening exams were completed for incoming first-year osteopathic medical students at the Western University of Health Sciences College of Osteopathic Medicine of the Pacific in August 2012. In this retrospective study, there were 208 participants, of which 15 had documented significant previous medical history. For the structural exam, rotational restrictions were assessed at OA, C7, T12, and L5. Myofascial restrictions were assessed at the craniocervical, cervicothoracic, thoracolumbar, and lumbosacral transitional zones.

This method of assessment creates 8 separate variables. These variables were recorded using a simple binomial system with 3 options: R for right rotation, L for left rotation, and O for lack of rotational restriction. The authors then evaluated these variables using kappa statistical analysis and the Fisher's exact test to determine if there was any statistically or clinically significant correlation present between the structural findings and the myofascial restrictions.

Results

Of the 208 participants, 14 individuals (6.731%) matched all 4 of the structural exam restrictions with the myofascial restrictions, 24 (11.538%) matched 3 of the 4 transition zones, 62 (29.808%) matched 2 zones, 73 (35.096%) matched 1, and 35 (16.827%) exhibited 0 matches.

From the Western University of Health Sciences College of Osteopathic Medicine of the Pacific. When this study was completed, Dr. Brohard was a fourth-year student at Western University and Dr. Thai was a third-year student.

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Of the 15 individuals with documented significant previous medical history, 2 individuals (13.333%) had all 4 matches, 1 (6.667%) had 3 matches, 6 (40%) had 2 matches, and 6 (40%) had 1 match.

Of the 198 individuals without significant limitations, 12 individuals (6.218%) had all 4 matches, 23 (11.917%) had 3 matches, 56 (29.016%) had 2 matches, 67 (34.715%) had 1 match, and 35 (18.135%) lacked any agreement between structural and myofascial findings.

On initial kappa analysis with all 208 participants, the authors found a total of 325 matches within the data, yielding a kappa value of 0.0527 with a 95% confidence interval of 0.0025 to 0.1028. For the 15 participants with medical limitations, the authors found the kappa value to be 0.2450 with a 95% confidence

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interval of 0.0615 to 0.4284 (P=0.0063). For the 198 individuals without limitations, the authors found the kappa value to be 0.0373 with a 95% confidence interval of -0.0147 to 0.0893 (P=0.1488).

Conclusion

Regarding the group of 208 participants, there is a weak, but statistically significant correlation between all data points. For the 15 individuals with significant medical limitations, there is a statistically significant correlation between structural and myofascial exam findings, excluding the lumbosacral transition zone. For the remaining 198 individuals, there is no statistically significant correlation between structural and myofascial findings.

Ambiguity of significant medical limitations and lack of interrater reliability should be addressed in future research. With the limitations of this retrospective pilot study, the authors hope to further investigate the correlation between myofascial restrictions and structural exam findings.

Introduction

Although Zink's Common Compensatory Pattern (CCP) is not a thoroughly investigated topic, current literature from the Osteopathic Survey of Somatic Dysfunction and Zink Compensatory Patterns in Solalá, Guatemala, suggests that Zink's CCP of L/R/L/R was observed in 29% of their participants.[1] Furthermore, a right rotation pattern of the cervicothoracic transitional zone was observed in 69% of participants. Within the 69%, 46% also had a compensated left rotation of their craniocervical and thoracolumbar zones.

While this research suggests that there is an increased prevalence of Zink's CCP within a population, the sample size was only 40 participants. This research, along with others, indicates that there may be an increased prevalence of this compensatory pattern, but so far, all research has involved only myofascial restrictions, with no data on segmental spinal rotation as evaluated in a typical osteopathic clinical screening exam.

The purpose of this retrospective study is to investigate the myofascial restrictions and the segmental spinal somatic dysfunctions to determine if there is a correlation between myofascial rotational restrictions and osteopathic structural exam findings. The authors hope that the study will provide more detailed information that will increase understanding of the compensatory patterns that may exist and increase understanding of how to apply this information in the clinical setting.

At the Western University of Health Sciences College of Osteopathic Medicine of the Pacific (WesternU/COMP) in Pomona, California, osteopathic medical students learn about Zink's CCP in the second year of their osteopathic philosophy and principles curriculum. The authors hope that this research will improve the educational experience of students by providing a stronger understanding of Zink's CCP and how it can be applied to the osteopathic clinical practice.

Background

One of the primary tenets of osteopathic medicine is that structure and function are interrelated within the body and that an issue with structure can compromise function. Because of this tenet, osteopathic physicians base much of their clinical philosophy on identifying dysfunction in the structure of the body in hopes of allowing the function to return to a normal state of health and homeostasis.

J. Gordon Zink, DO, FAAO, wrote about this relationship of the structure of the three diaphragms in the body and how they relate to overall function and homeostasis.[2]

Rather than looking at individual structural components, it has been proposed that one can group the human body into a series of structural and functional patterns. These patterns would make it possible to identify common patterns within a population as well as to tailor clinical approaches based on identified patterns.

One of these patterns commonly identified in patients is Zink's CCP.[3] Over many years of clinical practice, Zink discovered this pattern of somatic dysfunction in his patients and found that certain combinations exist more frequently among his patient population.

These patterns of somatic dysfunction typically involve the spinal transitional zones, which include: C0/C1/C2, C7/T1, T12/L1, and L5/S1. When there is somatic dysfunction present within 1 transitional zone, the adjacent transitional zones tend to compensate for this dysfunction. Once this compensation has occurred, a pattern often arises, involving somatic dysfunction at each of the transitional zones.

In the CCP as outlined by Zink, C0/C1/C2 is rotated to the left, C7/T1 is rotated to the right, T12/L1 is rotated to the left, and L5 is rotated to the right on the sacrum, which in turn induces a left-on-left forward torsion of the sacrum. In other words, a given patient would be expected to have a pattern of L/R/L/R in the spinal transition zones.[4-6]

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It has been proposed that this pattern can be identified through both myofascial and segmental assessments, but little information exists on the correlation between these findings. Zink also noted that patients with this CCP were not significantly limited in their daily function, and therefore this pattern may be one of health.[3]

TePoorten has since expanded upon Zink's concept by using a 10-step protocol of musculoskeletal manipulations to treat the 4 diaphragms of the body in order to promote a pattern of health.[7] If this concept is supported by research, then it can have significant implications for treatment protocols and patient care. Being able to apply these compensatory patterns in clinical practice may help osteopathic clinicians in their diagnostic assessment of patients and in their ability to effectively treat toward health.

Materials and Methods

All data used for this retrospective study were collected in August 2012 by second-year osteopathic medical students during initial osteopathic screening exams for incoming first-year osteopathic medical students at WesternU/COMP. The study was approved by Western University's institutional review board (Protocol #13/IRB/112).

These screening exams are conducted routinely for the incoming osteopathic medical students each year. The authors of this manuscript were not involved in the data collection process, and all identifying information was removed from the data before they were provided for use in this retrospective study.

There were 208 total participants, of which 15 had significant documented medical histories involving various pathologies. Because of the retrospective nature of this study, the authors did not have access to the criteria involved in determining which participants had significant medical history or other inclusion and exclusion criteria.

The data included segmental diagnoses for the atlantooccipital (OA), C7, T12, and L5 spinal levels in the standard recording method (F/E/N SL/SR RL/RR) as outlined in *Foundations of Osteopathic Medicine*.[5] Data also included gross rotational myofascial restrictions at the spinal transition zones as outlined by Zink and TePoorten.[2,6]

To evaluate for Zink's myofascial restrictions, the spinal transition zones were evaluated for gross rotational restrictions using the following assessment methods as described by Zink[3] and TePoorten[7]:

Craniocervical transition zone: Gentle rotation of the head was induced using the base of the occiput while the patient was supine.

Cervicothoracic transition zone: Gentle rotation of the shoulder girdle was induced using the clavicle-scapula complex by placing one hand on each shoulder with the patient supine.

Thoracolumbar transition zone: Gentle rotation of the lower rib cage was induced using ribs 10-12 with the patient supine.

Lumbosacral transition zone: Gentle rotation of the pelvic girdle was induced using the innominates by contacting the anterior superior iliac spines and iliac crests with the patient supine.

The methods used to record these data allowed the authors to use an organization scheme that resulted in 8 separate variables: OA rotation, C7 rotation, T12 rotation, L5 rotation, craniocervical–myofascial rotation, cervicothoracic–myofascial rotation, thoracolumbar–myofascial rotation, and lumbosacral–myofascial rotation. These variables were recorded using a simple binomial system with

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Figure. *Interpretation of the kappa statistic.*[8] *Table adapted from statisticshowto.com.*[9]

Kappa	Interpretation of kappa
0	Equivalent to chance agreement
0.10–0.20	Minimal agreement
0.21–0.40	Fair agreement
0.41–0.60	Moderate agreement
0.61–0.80	Substantial agreement
0.81–0.99	Almost perfect agreement
1	Perfect agreement

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3 options: R for right rotation, L for left rotation, and O for lack of rotational restriction.

Kappa analysis was used to determine whether statistically significant agreement or correlation existed between the findings on structural exam and myofascial evaluation. The kappa analysis gives a quantitative measure of agreement between 2 variables. With this numerical analysis, it can be determined whether agreement on findings between myofascial assessment and osteopathic structural exam occurred due to chance (κ=0) or perfect agreement (κ=1). Interpretation of kappa is typically as follows: 0=poor, 0.20=slight, 0.40=fair, 0.60=moderate, 0.80=substantial, 1.0=perfect agreement *(Figure)*.[8]

A Fisher's exact test also was used for statistical analysis. This test is very similar to a chi-squared test in that it compares values between 2 groups to determine statistical correlation, but it is better suited to evaluate small sample sizes due to added statistical constraints. The results of this test are represented by a *P*-value, which is considered statistically significant when less than 0.05.

Results

Upon initial evaluation of the raw data, the authors were able to identify the number of matches that existed between the 2 sets of data. These matches indicate a possible agreement between the structural findings and the myofascial findings.

Because the data points were collected at the 4 transition zones in the spine, this provided 4 separate variables to evaluate for matches. After all 208 data sets had been evaluated, it was found that there were 14 individuals (6.731%) whose structural findings perfectly matched the myofascial findings, of which only 1 individual held the L/R/L/R common compensatory pattern.

There were 24 individuals (11.538%) who exhibited a match in 3 of the 4 transition zones, 62 individuals (29.808%) with 2 matches, 73 individuals (35.096%) with 1 match, and 35 individuals (16.827%) who did not exhibit any matches between their structural findings and their myofascial findings.

The data were further split into 2 subgroups: those without significant medical history or limitations and those with limitations. Of the 15 individuals with significant limitations, 2 individuals (13.333%) had matches at all 4 transition zones, 1 individual (6.667%) had 3 matches, 6 individuals (40%) had 2 matches, and 6 individuals (40%) had 1 match.

Of the 198 individuals without significant limitations, 12 individuals (6.218%) had 4 matches, 23 individuals (11.917%) had 3 matches, 56 individuals (29.016%) had 2 matches, 67 individuals (34.715%) had 1 match, and 35 individuals (18.135%) lacked any agreement between structural and myofascial findings.

Kappa analysis was used to determine whether this agreement between findings is statistically significant or due purely to chance. Taking all variables into account separately, there are 832 total possible matches, and because a trinomial variable system was used, it was expected that there would be 275 matches (33.33%) simply by chance. On initial kappa analysis with all 208 participants, a total of 325 matches were found within the data, 50 more than expected by chance. This provided a kappa value of 0.0527 with a 95% confidence interval of 0.0025 to 0.1028.

Data were further broken into 2 kappa analyses: 1 for individuals with limitations and 1 without. For the 15 participants with medical limitations, the kappa value was 0.2450 with a 95% confidence interval of 0.0615 to 0.4284 (*P*=0.0063). For the 198 individuals without limitations, the kappa value was 0.0373 with a 95% confidence interval of -0.0147 to 0.0893 (*P*=0.1488).

These kappa results were again further broken down to evaluate agreement between variables at each of the spinal transition zones individually *(Table 1)*.

Due to the kappa analysis results of those individuals with significant medical limitations, a Fisher's exact test also was used to determine whether the presence of medical limitations correlated to the number of matches present between structural findings and myofascial findings. This test showed a *P*-value for association between limitation status and number of matches of 0.1762 *(Table 2)*.

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Discussion

Collecting data in 2 discreet sets, 1 for structural findings and the other for myofascial findings, allowed the authors to compare similar variables individually and to compare entire sets of findings. This means it is possible to observe a correlation between structural and myofascial findings and to observe whether or not the findings follow the compensatory patterns outlined by Zink.

The initial analysis of the raw data showed that there is a trend toward agreement of structural findings and myofascial findings when evaluating the 4 spinal transition zones. This was indicated by the percentage of matches found in the data, with a total of 325 matches out of a possible 832 matches. Based on chance alone, 275 matches would be expected within this data set. There were 50 more matches than expected, approximately a 6% increase over chance.

In addition, 14 of the 208 participants (6.731%) had 4 matches, indicating that their structural exam findings correlated perfectly with their myofascial findings at the 4 spinal transition zones. Furthermore, there were 24 individuals (11.538%) who exhibited a match in 3 of the 4 transition zones.

The overall kappa analysis yielded a value of 0.0527 with a 95% confidence interval of 0.0025 to 0.1028 (P=0. 0341), which indicates a moderate statistical significance. This looked at all variables collectively to see if there was any correlation, not considering how many matches exist within a single data set. The results were further broken down to determine if clinical limitations had an impact on the correlation between structural and myofascial findings.

Individuals with limitations had a kappa value of 0.2450 with a 95% confidence interval of 0.0615 to 0.4284 (P=0.0063), which represented a fair correlation between data.

For the remaining 198 individuals, the kappa value was 0.0373 with a 95% confidence interval of -0.0147 to 0.0893 (P=0.1488), indicating no statistically significant correlation between structural and myofascial findings. Therefore, at least in the individuals with medical limitations, there is a correlation between structural findings and myofascial findings at the spinal transition zones.

The kappa analysis results were broken down further *(Table 1)*, revealing that in individuals without limitations, there was a lack of statistical correlation at each of the spinal transition zones. In individuals with limitations, the previously identified correlation held true at each of the transition zones besides the lumbosacral transition zone.

Because these data indicated a correlation between findings only in individuals with medical limitations, a Fisher's exact test was performed to determine if having these limitations significantly increased the likelihood of a correlation between findings. In this test, the hypothesis was that having a significant medical history increased the participant's chance of agreement between structural and myofascial findings, and it increased the chance of a higher number of matches. Results showed that although a trend may exist in favor of this hypothesis, this trend is not statistically significant *(Table 2)*.

While evaluating the provided data, the authors were able to identify several areas of weakness or areas that can be improved in further studies.

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Table 1. *Individual kappa statistics were broken down into individual spinal transition zones for both subgroups of data sets. The table shows the number of matches (0, 1, 2, 3, 4) by limitation status (N=208).*

	0	1	2	3	4	Total
No limitations	35	67	56	23	12	193
Limitations	0	6	6	1	2	15

Table 2. *Results from Fisher's exact test for all participants. P-value from Fisher's exact test for association between limitation status and number of matches: 0.1762.*

	No limitations (n=193)			Limitations (n=15)		
Region	**Kappa**	**95% CI**	***P*-value**	**Kappa**	**95% CI**	***P*-value**
Craniocervical	-0.015	(-0.0116, 0.086)	0.7719	0.261	(-0.064, 0.585)	0.1134
Cervicothoracic	0.043	(-0.062, 0.148)	0.4017	0.323	(-0.069, 0.716)	0.0762
Thoracolumbar	0.026	(-0.074, 0.126)	0.5952	0.314	(-0.046, 0.673)	0.0692
Lumbosacral	0.095	(-0.010, 0.199)	0.0768	0.000	(-0.328, 0.328)	1.00

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Although the total sample size of 208 was adequate, when broken down into 2 groups, the group of students with limitations only had 15 participants. Although it may be enough to show trends in data, this number is insufficient to determine statistical significance of trends identified within the data. This may stem from a somewhat arbitrary method of classifying participants into the category of limitations. When the data were collected during the initial health screening, any participant who was flagged for screening by a physician was placed into the category of limitations. Because of this classification, there is no way to accurately state that these limitations have a significant impact on the outcome of this study, and in future research it would be useful to have more information about these limitations.

The other major weakness the authors identified in the method of data collection is possible lack of interrater reliability and consistency. The large number of incoming students required several second-year medical students to be involved in performing the evaluations. Though all data collectors were similarly trained second-year osteopathic medical students, it is difficult to say that each person's palpatory skills were similar enough to ensure a high level of consistency between raters.

Although these weaknesses may present significant limitations on the study, the authors feel that the trends identified still validly represent trends present in the overall population, and they plan to pursue them in future studies.

Since this is a retrospective study, it was used to identify these areas of weakness so that a much more precise method of data collection for a future study can be devised. For this further study, the authors plan to make several changes to ensure a higher level of precision and consistency in data collection.

The classification of medical limitation will be made using more specific findings on medical history to specify inclusion and exclusion criteria for the study groups. Using this method can ensure that the limitations being considered are likely to significantly affect outcomes, and it will allow trends to be identified within these specific limitations. This will also allow recruiting more participants that may fit into the limitations category so the sample size of that group can be increased.

To limit the error in interrater reliability, only 2 people will perform data collection on all future participants. One collector will perform the structural exam on every participant while the other data collector gathers myofascial data. This will ensure that all participants are evaluated in the same manner so that the data can be accurately evaluated.

To improve consistency and accuracy of the data collection, graders will be predoctoral teaching fellows within the Neuromusculoskeletal Medicine/Osteopathic Manipulative Medicine Department at WesternU/COMP who have completed their first 2 years of training and have participated in faculty-guided consistency training prior to the start of the study.

Once these limitations have been addressed, the accuracy and validity of the results will be greatly strengthened so that accurate conclusions can be drawn about trends present in the population and potentially correlate these findings to Zink's Common Compensatory Patterns.

Conclusion

Despite the limitations of this pilot study, the authors have been able to identify several interesting trends in the data thus far, raising a few questions to be answered in a follow-up study. Though generalizations cannot be made about the overall population at this point, it seems that within the data presented here, there is a correlation between structural exam findings and myofascial restrictions at the spinal transition zones.

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Based on this observation, it may be possible to screen for somatic dysfunction using a simple form of myofascial assessment. If so, it may allow for a quick assessment in the clinic or hospital setting and provide a great deal of information to help improve diagnosis and possibly treatment approaches to patient with somatic dysfunction. Also, this information may be used to improve osteopathic medical education and impact the clinical course of patients to improve outcomes and patient satisfaction.

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