
EDUCATIONAL RESEARCH IN ACTION

Allowing a Possible Margin of Error When Assessing Student Skills in Spinous Process Location

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Introduction: Spinal palpation is subject to inconsistency between examiners. When testing students on the location of vertebral spinous processes, faculty examiners may wish to allow for a margin of error that is observed between experienced practitioners. This study attempts to determine such a margin of error for selected vertebral levels that could be allowed in testing situations at Sherman Chiropractic College. This could serve as a model for other chiropractic colleges in determining their margins of error. **Methods:** Two faculty clinicians palpated spinous processes at four different vertebral levels (C2, T3, T9, and L2) on 18 student volunteers. Differences for each vertebral level, along with one, two, and three standard deviations, were calculated. **Results:** Average differences between examiners increased caudally, as follows: C2, 4.23 ± 3.77 mm; T3, 13.41 ± 10.53 mm; T9, 18.17 ± 17.62 mm; L2, 18.70 ± 16.58 mm. **Discussion:** In this study, faculty examiners exhibited variation in their locations of spinous processes for these vertebrae. These variations could be allowed when assessing student skills in locating these spinous processes at this chiropractic college. **Conclusion:** In this study, differences between examiners plus or minus one standard deviation ranged from 4.23 ± 3.77 mm for C2 to 18.70 ± 16.58 mm for L2. The concept of margin of error should be considered by faculty examiners when assessing the skill of students in locating the spinous process of various vertebral levels. (J Chiropr Educ 2011;25(2):182-185)

Key Indexing Terms: Educational Measurement; Health Education; Interobserver Reliability; Palpation

INTRODUCTION

Palpation is a psychomotor skill that many chiropractors use in their analysis of the spine. Chiropractors use palpation to feel specific vertebral segments of the spine to determine possible misalignments, or to find muscle tightness and spasms, or to determine motion restriction within the spine.¹ It is important that any health care professional needing to locate spinal levels on a patient realize that there is variability in patients' anatomy on the one hand and some degree of examiner error on the other.² In a recent literature review on the reliability of static

spinal palpation, a procedure used in the present study, a low amount of agreement was revealed among three methods of static palpation.³

In chiropractic education, faculty clinicians assess students in their palpation skills. One method of assessment pertains to the student's skill in locating the spinous process of a particular vertebral segment. For example, the faculty examiner may ask the student to locate the spinous process of T9 vertebra on a volunteer patient. The faculty member has a predetermined idea of where this spinous is on the volunteer. When the student indicates the location, the examiner then decides whether or not the student is correct in locating the spinous. Although spinous processes are generally fairly accessible for palpation purposes, the student and examiner may arrive at different locations for the same spinous. The question then is, which location is accurate? Granted that faculty examiners

The Journal of Chiropractic Education
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Vol. 25, No. 2. Printed in U.S.A.
1042-5055/\$22.00

typically have more experience than students in clinical matters such as palpation, the question of accuracy nonetheless remains a question. One approach for determining accuracy is to assess the agreement between experts. In the present context, this means that faculty who are experienced in the clinical art of palpation could be assessed on their level of agreement in the location of spinous processes of particular vertebral segments. The present study seeks to assess the level of agreement between two experienced faculty clinicians in locating the spinous process in four different vertebral segments. The rationale for the study is that assuming there is some amount of variation between faculty examiners, perhaps at least this same amount of variation could be allowed for students in test situations.

METHODS

This study was approved by the Institutional Review Board at Sherman College of Chiropractic, where it was conducted. Two faculty members at Sherman College who are experienced clinicians in the area of palpation, and are instructors in palpation classes, were invited to participate in the study as examiners. Eighteen relatively healthy student volunteers were recruited via the convenience sample method and the group consisted of five females and 13 males with a mean age of 27.7 ± 2.9 years. The examiners independently palpated for the spinous processes of C2, T3, T9, and L2 on the participants lying in the prone position. The examiners were blinded to each other's findings and their order for examining the participants was varied (but not randomized). Since both examiners teach and test at the same chiropractic college, rehearsal was not thought to be necessary. Methods of locating the spinous consisted of counting the segments, starting at C2 and then moving inferiorly toward L2, and verifying against landmarks along the way. In an effort to quantify examiner findings, a cloth measuring tape was affixed along the paraspinal region of each participant and secured with cellophane tape. Other than light conversation between examiner and participant (eg, a "hello"), participants did not speak to examiners (eg, indicating if and where they had pain). When the examiner found a particular spinous process on a particular vertebra, he placed his fingertip on the spinous process and the corresponding number, to the nearest 1/8 inch (approximately 3 mm), was noted by a second examiner. For example, examiner 1 palpated the

C2 spinous at 13/8 inches and T3 spinous at the 64/8 (8-inch) mark while examiner 2 had findings for these same segments at the 12/8 and 57/8 marks, respectively, on the tape.

Data analysis, performed in Excel (Microsoft Corp., Redmond, WA), consisted of determining the average difference and standard deviation in inches between examiners for each vertebral segment. Summary data are reported in millimeters. Some sources consider an outlier (an unexpected or unusual finding) as an observation that falls beyond three standard deviations.^{3,4} However, in this study, all findings were included and summary statistics include means plus one, two, and three standard deviations. Data analysis also consisted of determining agreement between examiners using the intraclass correlation coefficient (ICC) in PASW 17 (SPSS/IBM, Somers, NY) using the two-way mixed consistency, 95% CI, test value = 0 model.

RESULTS

Agreement between examiners was acceptable, with ICC coefficients ranging from 0.719 to 0.910 (Table 1). One of the segments, C2, showed a difference greater than three standard deviations from the mean (mean difference = 4.23 mm), but this difference was only 0.33 mm greater than the three standard deviations from the mean. Consequently, this data point was included in the analysis and was the only datum that came close to being considered as an outlier. The average difference in millimeters between examiners was as follows: C2, 4.23 ± 3.77 mm; T3, 13.41 ± 10.53 mm; T9, 18.17 ± 17.62 mm; L2, 18.70 ± 16.58 mm. These values, along with two and three standard deviations from the mean, are reported in Figure 1.

DISCUSSION

Limitations to Study

Among the limitations to the study is the lack of rehearsal between examiners. However, given that one of the main purposes of the study was to determine agreement between faculty examiners and that students are tested by both of these faculty examiners, the magnitude of this limitation seems small. Another limitation is the convenience sample design. As a point of clarification, the study's purpose was not so much to use examiners as a gold standard for level of agreement

Table 1. Intraclass correlation coefficient between examiners

	Segment				Average
	C2	T3	T9	L2	
ICC	0.760	0.774	0.719	0.910	0.902
<i>p</i> Value	.000	.000	.000	.000	.000

Single measures except for last column.

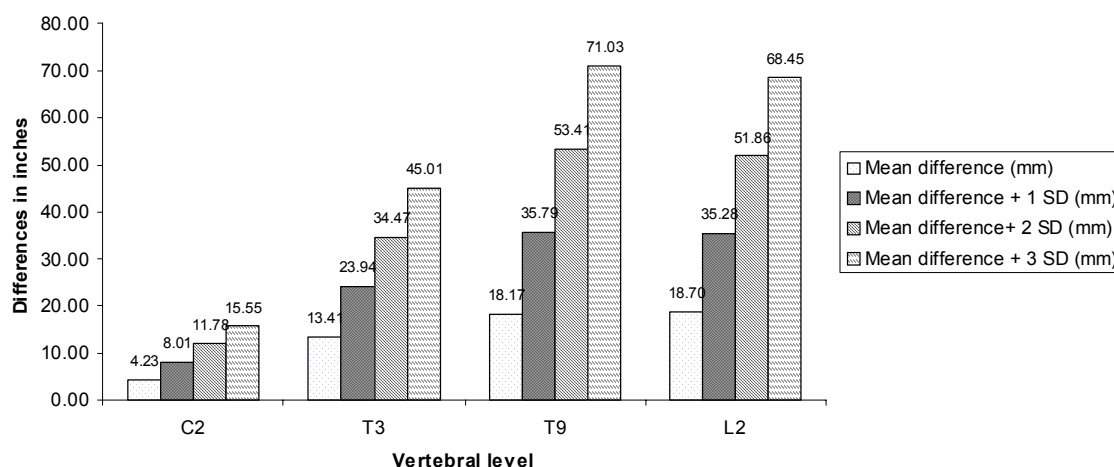


Figure 1. Mean differences (mm) for spinous process location between two faculty member examiners experienced in palpation.

between faculty and students, but rather to show that a margin of error could be allowed when assessing students based on faculty margin of errors.

In this study, examiner differences for location of spinous processes were lowest for the most superior segment assessed and increased linearly inferiorward toward L2. Obviously, the more standard deviations that are applied, the larger is the amount of difference that could be allowed. The intent of this study was to provide a margin of error that might be allowable when faculty at Sherman College assess student palpation skills in locating a particular spinous process. Faculty at other colleges may wish to perform a similar study to see what, if any, margin of error might be allowable at their institutions. Given the potential for different teaching methods for palpation, these findings are more generalizable to other student cohorts at Sherman College than to other chiropractic colleges. Further research could also assess

examiner differences for all spinous processes.

Implications

The practical implications of these findings for this program can be exemplified in the following testing scenario. If the student found a C2 spinous process that was, perhaps, 12 mm (approximately ½ inch) from where the faculty examiner thought the C2 spinous process actually was, then this difference would be outside the average plus or minus two standard deviations for C2 that the experienced practitioners in this study were observed to exhibit. Various chiropractic programs would have to decide on how much variation (eg, number of standard deviations) to allow for the various segments palpated. One, two, and three standard deviations are provided in Figure 1 for each segment assessed in the present study.

CONCLUSIONS

This study revealed that these faculty clinicians who are experienced in palpation displayed levels of agreement that varied somewhat for locating the spinous process on specified vertebral levels and that this variation could be allowed when assessing student palpation skills for spinous processes on these vertebrae at this chiropractic college. This study may serve as a model for other chiropractic colleges when they assess their possible margins of errors among their faculty examiners.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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REFERENCES

1. Sherman College Clinical Faculty. The Sherman system of spinal analysis. Spartanburg, SC: Sherman College of Chiropractic; 2008.
2. Cooperstein R, Haneline M. Spinous process palpation using the scapular tip as a landmark vs radiographic criterion standard. *J Chiropr Med* 2007;6(3):87-93.
3. Haneline MT, Young M. A review of intraexaminer and interexaminer reliability of static palpation: a literature synthesis. *J Manipulative Physiol Ther* 2009; 32:379-86.
4. Barber S. User experience, not metrics. Part 6: What is an outlier and how do I account for one? IBM [cited 2010 July 29]. Available at: <http://www.ibm.com/developerworks/rational/library/4240.html>.
5. MathWorks.com. Inconsistent data [cited 2010 Aug 10]. Available at: http://www.mathworks.com/access/helpdesk/help/techdoc/data_analysis/f0-7275.html.