The relationship of craniosacral examination findings in grade school children with developmental problems

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A standardized craniosacral examination was conducted on a mixed sample of 203 grade school children. The probabilities calculated supported the existence of a positive relationship between elevated total craniosacral motion restriction scores and the classifications of "not normal," "behavioral problems," and "learning disabled," by school authorities, and of motion coordination problems. There was also a positive relationship between an elevated total craniosacral motion restriction score and a history of an obstetrically complicated delivery. The total quantitative craniosacral motion restriction score was most positively related to those children presenting with multiple problems.

This research was undertaken to determine if there is a relationship between restricted mobility of the craniosacral system and developmental problems in grade school children, particularly "exceptional children," those who have learning disabilities and emotional impairments.

A standardized craniosacral examination was designed and conducted on each of a mixed sample of 203 grade school children by the author. A study of interexaminer agreement for the reliability of the examination protocol was previously done by the author with three other examiners.[1]

The work and results described herein represent a part of a broader research project that is still under way. The ultimate goal of this research is an evaluation of the efficacy of craniosacral osteopathic manipulative therapy as it applies to "exceptional children." Collaborative work is presently under way by investigators in the areas of education and psychology to more clearly categorize and define the individual problems of these "exceptional children."

The ultimate goal of the investigators is to determine if significant relationships exist between specific craniosacral restriction patterns and learning and/or behavioral disorders. A significant relationship has been shown. An experimental treatment program is in progress.

The weaknesses of the present categorization methods for the children's problems are recognized. These weaknesses are being addressed at the present time.

Prior to completion of the examinations and the written recording of the results in the present study, the examiner had no knowledge of any specific problems afflicting any of the children.

The examination

Table 1 is the standardized examination form which was completed for each of the children.

Precautions were taken to minimize the possible effect of other cues to the examiner on the conduct and reporting of the results of the craniosacral examination. A research assistant recorded the name, age, height, and weight of each child before summoning the examiner. The parents had no significant contact with the examiner prior to the examination. The initial contact between the examiner and the subject was in the examination room. Every effort was made to have the child lying quietly in the supine position on the table when the examiner entered the room.

Prior to the craniosacral motion testing, the examiner's pulse and respiratory rates were taken and recorded by the research assistant, as were the pulse, respiratory, and cranial rhythmic impulse rates of the child.[2] Obvious asymmetries noted visually and by palpation were then orally reported to the research assistant.

Next, each motion variable (Numbers 1 to 19, Table 1) of the craniosacral system was carefully tested and rated on a scale of 1 to 3. Motion variables were tested and reported in a specific sequence (Table 1) to eliminate differences which might result from varying the order of motion testing. Each motion was tested and rated in terms of restriction of response to a force applied in a given direction. In rating the restriction or resistance to a given tested

TABLE 1. — STANDARD EXAMINATION FORM

Subject's name _____ Date _____
Age _____

Height _____ Weight _____

Cardiac pulse rate/minute _____ Cranial pulse rate/minute _____

Respiratory rate/minute _____

Cranium — obvious asymmetries (face, orbits, ears, brows, forehead, mandibular deviation — mouth open and closed)

Sutures — tissue texture abnormalities and overriding noted

Motion Variables		Rating
1	— Occiput — Right restriction of motion	
2	Left restriction of motion	
3	— Temporal bones — Right restriction of motion	
	Left restriction of motion	
5	— Cranial vault — Restriction toward flexion (Extension lesion*)	
6	Restriction toward extension (Flexion lesion*)	
7	Side bending rotation, restriction toward right (Left side bending and restriction lesion*)	
8	Side bending rotation, restriction toward left (Right side bending and restriction lesion*)	
9	Torsion, restriction toward right (Left torsion lesion*)	
10	Torsion, restriction toward left (Right torsion lesion*)	
11	Compression-decompression restriction	
12	Lateral strain, restriction toward right (Left lateral strain lesion*)	
13	Lateral strain, restriction toward left (Right lateral strain lesion*)	
14	Vertical strain, restriction toward superior motion (Inferior vertical strain lesion*)	
15	Vertical strain, restriction toward inferior motion (Superior vertical strain lesion*)	
16	— Sacrum — Restriction toward flexion (Extension lesion*)	
17	Restriction toward extension (Flexion lesion*)	
18	Restriction toward right torsion (Left torsion lesion*)	
19	Restriction toward left torsion (Right torsion lesion*)	

Examiner — Name _____
Cardiac pulse rate/minute _____
Respiratory rate/minute _____

All motion variables rated: 1 = No restriction
1.5 =
2 = Moderate and transitory
2.5 =
3 = Severe restriction

*Traditional Cranial Academy terminology for "naming the lesion."

examiner-induced motion, quantitative scores were assigned: a score of 1 equals no restriction; 2 equals moderate and/or transitory restriction; 3 equals severe restriction. Ratings of 1.5 and 2.5 were allowed. The resistance to (restriction against) that motion was reported and rated rather than the "*positional* lesion." This liberty was taken by the author in order to minimize conceptual error and controversy related to the cause of the restriction. It is our goal to simply note that the restriction was discovered.

In testing the types of motion, gentle movement of the head in the desired direction was initiated by the examiner. The motion was then monitored until it reached a restricted end point. Range-of-motion, bilateral equality, and ease or restriction to motion, as initiated by the examiner, were evaluated.

The exact procedure for testing each of the 19 parameters shown in Table 1 was as follows.

Parameters 1 and 2–Occiput, right and left

With the patient comfortably supine and the examiner comfortably seated at the head of the table, the examiner's hands were laid palms up on the table so that the ulnar sides of the two hands approximated each other. The fingers were flexed between 60 and 90 degrees. The fingertips were placed in contact with the patient's occipital region in a (nearly) symmetrical fashion immediately caudad to the superior nuchal line. The examiner's fingertip contact was allowed to remain passive until the soft tissues relaxed and the examiner could sense the firmness of the deeper bony structures. Once this relaxation of soft tissue occurred, gentle traction was applied in a postero-cephalad direction. As the occiput moved in compliance with this traction, a gentle laterally directed force was added to the traction by each of the examiner's hands. The resistances of the two sides of the occiput to this examiner-induced passive motion were then rated individually on the 1 to 3 scale.

Parameters 3 and 4–Temporal bones, right and left

For testing of restriction to motion of the temporal bones, the examiner and the patient remained in the same relative positions as aforementioned.

The patient's occiput was gently cradled in the examiner's interlaced fingers (hands palms up). The examiner's thumbs were positioned so that they were in contact with the temporal mastoid processes and tips.

First, a side-to-side motion was gently induced so that when one mastoid tip was pressed medially, the opposite tip was allowed to move freely in a lateral direction and vice versa. The motions were tested in rhythm with the cranial rhythmic impulse (CRI).* Several excursions were monitored. Then, resistance to a very minute circular motion of the temporal bones was tested. The axis of this motion can be conceptualized as running through the external auditory canal and through the petrous portion of the temporal bone. Resistance to these examiner-induced motions was rated on each side in terms of its severity. Before terminating this temporal bone testing, symmetry of motion was restored by the examiner.

Parameters 5 through 15–Sphenobasilar joint

These parameters were all tested using the "vault hold." The positions of the subject and the examiner were unchanged except for the application of the examiner's hands to the subject's head.

The "vault hold" is the descriptor for the method of application of the examiner's hands to the subject's head. This application was for the evaluation of the interosseous motions which are conceptualized to occur between the bones of the cranial vault. The index fingers of each hand were applied gently to the area overlying the external surfaces of the great wings of the sphenoid. The fifth fingers of each hand rested in contact with the occipital squama

*The cranial rhythmic impulse (CRI) is an involuntary, physiologic, rhythmic motion which has been reported by those skilled in cranial osteopathy. It is perceived by the examiner as his hands are gently and passively placed upon the subject's head. The perceived rhythm is reportedly not in synchrony with the cardiovascular and respiratory rhythms of either the subject or the examiner.

approximately one-half inch medio-posterior to the occipito-mastoid suture above the superior nuchal line. Some slight differences in the placement of these fingers may result if examiners have small hands, or if a head is relatively large in size, but this does not interfere with the proprioceptive cues that can be perceived.

The third and fourth fingers of each hand were not used in the motion-testing process during sphenobasilar evaluation. The thumbs did not contact the subject's head but did contact each other. They served to provide the examiner with proprioceptive and kinesthetic cues about the equality of motion when movements in one direction were compared with reciprocal movements in the opposite direction.

The types of cranial motion tested using the vault hold were:

Parameters 5 and 6—Flexion-extension.

Parameters 7 and 8—Right and left side bending with a degree of rotation.

Parameters 9 and 10—Right and left torsion.

Parameter 11—Compression-decompression.

Parameters 12 and 13—Right and left lateral strain.

Parameters 14 and 15—Vertical strain in superior and inferior directions.

Parameters 5 and 6–Flexion-extension

Using the vault hold, the examiner exerted a gentle force over the occipital squama and great wings of the sphenoid concurrently. This force was directed caudad and was applied by his paired index and fifth fingers. The thumbs were in contact with each other and furnished proprioceptive and kinesthetic cues so that the examiner's force was applied as symmetrically equal as possible. After the cranium responded to the initiating force (of approximately 5.0 grams or less), the examiner became passive and followed the cranial motion to its restricted end point. This was the test for flexion. Restriction against this examiner-induced motion was then rated and reported after comparison with restriction encountered when testing for extension, next.

To test for extension, a similar bilaterally equal force was applied by the examiner in a cephalad direction. The testing was then repeated until the examiner gained a reliable impression as to the relative ease/restriction of these reciprocal motions.

Parameters 7 and 8–Side bending-rotation, restriction toward right and left, respectively

The vault hold was applied as aforementioned. In order to test for restriction toward side bending-rotation toward the right, the examiner's left index and fifth fingers were gently moved cephalad and medialward while slightly approximating each other. Resistance (restriction) to this examiner-induced passive motion was compared with side bending-rotation motion testing toward the left. In order to test for restriction toward the patient's left, the examiner repeated the same procedure using his right hand. Restrictions were rated on the 3 point scale, each side individually.

Parameters 9 and 10–Torsion-restriction toward the right and left, respectively

Using the vault hold, the examiner applied a gentle force with the index finger of one hand and the fifth finger of the other hand simultaneously in a superior (cephalad) direction. First, testing was completed for torsion on one side and, then, after allowing the motion to return to a position of easy neutrality, testing was completed on the opposite sides. The forces were extremely gentle. Following the initiation of motion by the examiner, the motion was monitored to its restricted end point. The restriction was rated for the side on which the great wing of the sphenoid bone resisted superior motion; if the left great sphenoid wing and the right occipital squamous moved easily in a superior direction, but

the right great wing and the left squamous moved superior (cephalad) with difficulty, the restriction was rated as a 2 or 3 on the right side in reference to the right wing of the sphenoid bone offering resistance to the superior motion.

Parameter 11–Compression-decompression restriction

Using the vault hold, the examiner exerted a force over the great wings of the sphenoid bone with his index fingers. This force was in a frontal direction away from the fifth fingers which were gently immobilizing the areas over the occipital squama. It is essential that this force be applied as bilaterally equally as possible. The examiner's thumbs in contact with each other furnish valuable kinesthetic and proprioceptive cues during this testing procedure. Following the initiation of the motion, it was monitored to the restricted end point and rated on the 3 point scale (ease/restriction in response to the initiating force). A free anterior-posterior expansion motion (indicated by ease of motion in a frontal direction) suggested the absence of compression.

Parameters 12 and 13–Lateral strain-restriction toward the right and the left, respectively

Using the vault hold, the occiput was gently held immovable by the examiner's fifth fingers. The index fingers were then used to induce motion and test restriction bilaterally on a horizontal plane in a direction at approximate right angles to the median sagittal plane of the subject's head. Restrictions toward this induced motion were rated and recorded toward the right and toward the left of the examiner.

Parameters 14 and 15–Vertical strain-restriction of superior motion and inferior motion, respectively

Using the vault hold, the occiput was gently held immovable by the examiner's fifth fingers while his index fingers (overlaying the great wings of the sphenoid bone) exerted a gentle symmetric force on a frontal plane first in a superior (or cephalad) direction, and then in an inferior (caudad) direction. As the vestical motion carries to its end point, it can be perceived that it possesses an arcing component which is directed posteriorly. Restrictions were rated as they limited the superior and/or inferior response to motion testing in those directions.

Parameters 16, 17, 18, and 19–Sacrum

All four of these parameters were tested with the patient supine upon the upturned palm of the examiner's right hand. The spine of the sacrum rested in the space between the examiner's third and fourth fingers. The sacral apex and coccyx rested in the examiner's upturned palm. The tips of the examiner's third and fourth fingers were just lateral to the spinous processes of the fourth or fifth lumbar vertebra (depending on the patient's size). The distal aspects of the examiner's index and fifth fingers were in contact with the superior lateral aspects of the sacrum.

Parameter 16

The test for restriction toward sacral flexion was performed by using the examiner's palm to gently induce an anterior motion of the sacral apex.

Parameter 17

The test for restriction toward sacral extension was performed by inducing an anterior motion of the sacral base. Both of these motions were tested through several cycles of the CRI and the restrictions to examiner-induced motion toward both flexion and extension were rated on the 1 to 3 scale.

Parameters 18 and 19–Restriction toward right and left torsion, respectively

The examiner maintained the same manual contact with the patient's sacrum as was used for testing Parameters 16 and 17. To test for restriction toward right torsion, pressure was applied in an anterior direction on the left sacral base area. Pressure on the

right side was applied similarly to test for restriction toward left torsion motion. Both parameters were then rated on the 1 to 3 scale for restriction toward induced passive motion.

The sample

Two hundred and three subjects for this study were obtained by parental response to written notices taken home by children attending Ingham County Grade Schools and by children enrolled in the MSU Motor Coordination Clinic. These notices informed parents of the objectives and protocol of the research. Cooperation and signed consent of interested parents was requested.

There was also some direct communication between a limited number of interested special educators and school nurses, and the parents of "exceptional children."

Parents who expressed a desire to have their children participate in the research (by returning the signed consent form to the cooperating agency) were then contacted by the research assistant who arranged all appointments for examinations, reviewed pertinent records, and obtained developmental and other historical data. There was no situation in which the examiner had significant contact with parent or subject prior to completion of the carniosacral examination.

Significant data were then extracted from these records and histories by the research assistant in cooperation with the statistical analysis consultant (Eric Gordon, Ph.D.). Eight categories of significant problems were then decided upon by Dr. Gordon (Table 2). Categories 1 to 4 were considered the major problem areas. Categories 5 to 8 represent factors from the history that were considered as possibly clinically significant.

The criteria for entry into one of the eight problem categories were as follows.

Category–Normal-Not Normal†

A child was considered "not normal" in this category only if one of the following criteria were met:

(1) A classroom teacher had first suspected that the child manifested a problem which would label that child as "exceptional." (The problem could have been in either the behavioral, motor coordination, and/or learning disability area.)

(2) The classroom teacher felt strongly enough about that suspicion to seek and obtain evaluation by a specialist in either psychology, motor coordination, and/or remedial education.

(3) That specialist did, in fact, concur with the classroom teacher's opinion and recommended appropriate specialized treatment or a training program for the child in question.

Children classified as "Not normal" in category 1 were *not* so classified on the basis of a teacher's opinion alone, nor was this classification made solely on the basis of the parent's opinion. Confirmation by an appropriate specialist was a required criterion.

TABLE 2. EIGHT PROBLEM CATEGORIES CONSIDERED SIGNIFICANT FOR DATA COLLECTION.

Category	Diagnosed by
1—"Normal — Not normal"	School authorities
2—Behavioral problems	School authorities
3—Motor coordination and speech problems	School authorities Motor Coordination Clinic
4—Learning disabilities	School authorities
5—Seizure history	History obtained from parents
6—Head injury	History obtained from parents
7—Obstetrical complications	History obtained from parents
8—Ear problems (History of with or without hearing loss)	History obtained from parents

†The author recognizes that the terms "normal" and "not normal" are not truly definable. Classroom teachers, however, did use this terminology in describing the subjects examined in the project. Therefore, these descriptions have been used in reporting this research.

There were 164 children categorized as "Normal" and 39 children classified as "Not normal" in this category.

Category 2–Behavior problems

Children were placed in this category on the following bases:

(1) when a specialist in the field of psychology (usually a school psychologist) had so indicated on the school record.

(2) when the child had proven to be unmanageable to the parent so that professional evaluation (child psychologist or pediatrician) had been obtained privately and confirmed the parent's suspicion.

There were 10 subjects with positive findings in Category 2 (Table 3) wherein the parent and not the classroom teacher sought professional help for "behavioral problems." In all of these cases a professional psychologist had confirmed the problem, even though the children's school conduct was not considered exceptional by the teacher. Therefore, these subjects were considered as "normal" in category 1. All other children in this problem category (2) were considered "not normal" and to have "behavioral problems" by thir teachers.

Category 3–Motor coordination and speech problems

All children in this problem category were referred from the MSU Motor Coordination Clinic, where a problem in this area of development had been confirmed. There were 19 subjects with diagnosed motor coordination problems who were considered "normal" in category 1 by the school teachers (Table 3). Therefore, they were considered as "normal" in category 1. All other motor coordination problems were noted as such by the classroom teachers.

Category 4–Learning disabilities

Children were considered "learning disabled" if the classroom teacher noticed the problem, obtained confirmation from a specialist, and had the child placed in a special education program.

There were four exceptions to these criteria, which were included in the data. In these cases (Table 3), the "learning disability" was noticed first by the parents who obtained private evaluations by a psychologist. The parents' suspicions were confirmed and the children were placed in private schools which specialized in remedial training of "exceptional children."

This category included problems such as dyslexia, dysgraphia, anomia, dysphasia (both receptive and expressive), and dyscalculia.

Category 5–Seizure history

All children in this category had a history of at least one episode of seizure or convulsion. Most of these histories were validated by professional medical histories furnished by parents. However, if a parent reported and described the incidence of seizure or convulsion and the description of the event seemed accurate, the child was placed in this category.

The purpose of collecting these data was to uncover significant relationships between seizure history and craniosacral restrictions, as well as to illuminate this problem category as a possible contributing factor for positive findings in categories 1 to 4.

Category 6–Head injury

Children were placed in this category on the basis of information from parents and from medical records when available. The research assistant attempted to eliminate minor "bumps" and "cuts" on the head from this category.

The unreliability of data obtained is recognized; however, only those children with history of hospitalization, "concussion," fracture and/or unconsciousness were included.

The purpose for the inclusion of this category was to search for areas which may, in fact, justify more

in-depth investigation of head injuries as possible contributing factors to the problem of "exceptional children."

Category 7–Obstetric complications

The criteria for classifying a delivery as obstetrically complicated were one or more of the following:

(1) Cesarean section
(2) High forceps delivery
(3) Induction of labor for reasons other than convenience
(4) Fetal distress in utero
(5) Breech delivery
(6) Prolonged labor
(7) Precipitous labor
(8) Toxemia of pregnancy
(9) Severe trauma during pregnancy which resulted in pelvic fracture

All information was obtained from the parents. Documentation was occasionally available from medical records; however, this was the exception.

Even though the validity of these data may be questionable, the investigators included the category in order to uncover tendencies toward correlation between obstetric complications as a contributing factor to problems in categories 1 to 4, and a correlation between craniosacral restriction patterns and obstetric complications. More in-depth study seems justified by these results.

Category 8–Ear problems

Children placed in this category had histories of myringotomy, hearing deficit, or recurrent ear infections (at least 5 repetitions) which had required treatment by a physician. Otitis externa was not included.

This category was included simply because of the frequency with which the problem occurred in the histories. The statistical analysis does not appear to justify further study.

The occurrence of problems in categories 2 through 8 for the 164 children examined who were classified as "normal" by the classroom teachers and school authorities are presented in Table 3. One hundred and thirty-five of these 164 children had no classifiable problems in categories 2, 3, and 4 (behavioral, motor-speech, and learning disabilities, respectively).

Subject children numbers 1 through 41 presented no classifiable problems within this study. Subjects 42 through 135 presented positive findings only in categories 5 through 8, which are being investigated as possible contributing factors. The occurrence of positive findings in categories 2, 3, and 4 in "normal" subjects 136 through 164 has been explained in the aforementioned paragraphs which deal with those categories.

The column on the extreme right of Table 3 indicates the quantitative total scores given each subject for the craniosacral examination.

The occurrence of other problems in categories 2 through 8 for the children who were classified as "not normal" by classroom teachers and school authorities is listed in Table 4. The total quantitative craniosacral examination score is given in the column on the extreme right of the table.

Comparison of Tables 3 and 4 provides an overview of the density of problem occurrence in categories 2, 3, and 4 when children were classified as "normal" or "not normal" in category 1. (This comparison lends support to the validity of the classroom teacher's opinions of the normalcy of the child's development.)

Statistical analysis

This investigation involved three types of statistical measures:

(1) Summary descriptive statistics were used to describe the sample.

(2) Two tailed "t" tests were used to test the differences in mean scores between patient groups in the various categories.

TABLE 3. OCCURRENCE OF OTHER PROBLEMS FOR CHILDREN CLASSIFIED AS "NORMAL" IN CATEGORY 1.

Subject number	Category 2	3	4	5	6	7	8	Total cranio-sacral exam (Σ V) score*
	No positive findings in categories 1 through 8							
1								22.5
2								23.0
3								27.0
4								21.5
5								22.0
6								28.0
7								22.0
8								28.0
9								24.5
10								21.0
11								31.0
12								24.5
13								23.0
14								25.0
15								31.0
16								23.0
17								24.0
18								34.0
19								32.0
20								27.5
21								22.5
22								30.0
23								26.5
24								25.0
25								23.0
26								24.0
27								24.0
28								21.5
29								23.0
30								26.5
31								22.0
32								23.5
33								25.0
34								28.5
35								22.0
36								24.5
37								27.5
38								23.0
39								20.5
40								22.0
41								29.0

TABLE 5. (continued)

Subject number	Category 2	3	4	5	6	7	8	Total cranio-sacral exam (Σ V) score*
	Children with no positive findings in categories 1 through 6, but with positive findings in the contributing categories 5 through 8							
42						X		26.5
43					X			22.0
44				X		X	X	27.0
45						X	X	28.5
46				X				22.0
47					X			27.0
48					X		X	23.5
49				X		X		29.5
50					X		X	25.0
51				X			X	26.0
52							X	26.5
53						X		31.0
54						X		25.0
55					X			25.5
56						X		22.0
57					X	X		24.5
58						X		23.5
59				X	X	X	X	25.5
60					X	X	X	26.5
61						X		24.5
62					X	X	X	21.5
63					X			30.5
64					X	X		28.0
65					X			24.0
66					X			24.0
67					X		X	26.5
68					X			27.5
69						X		28.0
70					X		X	24.0
71				X		X	X	19.0
72					X			23.5
73					X	X		25.5
74						X		23.5
75					X			19.0
76							X	23.5
77					X			34.5
78							X	22.5
79				X	X			24.0
80				X		X		26.0
81					X			25.0
82					X			22.5
83					X	X		26.0
84				X	X			26.5
85						X	X	35.0
86				X	X	X		27.0
87						X		27.0
88				X			X	24.0
89						X		26.0
90					X		X	24.0
91					X	X		25.5
92					X			23.0
93					X			25.5
94				X	X			21.5
95					X			34.0
96					X			27.0
97				X				25.0
98					X			24.0
99					X	X	X	27.5
100							X	24.0
101						X		24.5
102					X	X	X	23.5
103					X			29.5
104					X			27.5
105						X		28.0
106					X		X	24.5
107							X	27.0
108					X	X	X	28.5

Subject number	Category 2	3	4	5	6	7	8	Total cranio-sacral exam (Σ V) score*
109				X	X			25.0
110						X		25.0
111					X			26.0
112							X	23.5
113					X	X	X	21.5
114					X			24.5
115							X	26.0
116				X				34.0
117					X			28.0
118					X		X	24.5
119					X			24.0
120					X			25.0
121						X	X	24.5
122					X	X		25.5
123					X			30.0
124					X	X	X	27.0
125							X	25.5
126					X		X	23.0
127							X	23.5
128					X		X	36.5
129					X	X	X	27.0
130				X	X		X	21.5
131					X			22.0
132						X	X	22.0
133					X		X	23.5
134					X		X	28.0
135							X	27.0
Occurrence of positive findings in categories 2, 3, and 4 in children categorized as "normal" by teachers								
136		X						24.5
137		X						24.0
138		X			X		X	22.5
139	X				X	X		27.0
140	X			X		X		27.0
141	X					X		26.0
142			X		X			34.0
143		X					X	25.5
144		X			X			28.0
145		X			X			26.0
146	X							30.0
147		X			X	X		35.0
148		X						20.0
149		X			X			34.5
150		X	X					23.5
151		X				X		29.5
152	X		X					30.0
153	X	X			X		X	29.0
154	X				X		X	39.5
155		X						21.0
156		X			X			32.0
157	X				X	X		31.5
158		X			X			29.5
159	X							22.5
160	X					X		32.5
161		X				X		37.0
162		X	X			X		28.5
163		X			X			26.5
164		X		X		X	X	28.5

*Perfect score (no restriction) = 19

TABLE 4. OCCURRENCE OF OTHER PROBLEMS FOR CHILDREN CLASSIFIED AS "NOT NORMAL" IN CATEGORY 1.

Subject number	Category 2	3	4	5	6	7	8	Total cranio-sacral exam (Σ V) score*
165		X		X		X		29.5
166	X		X					27.0
167	X	X	X			X		37.5
168		X	X			X		29.5
169	X		X			X		33.5
170		X			X			25.5
171		X						20.0
172	X	X			X	X	X	29.0
173		X	X			X		39.0
174		X				X		32.0
175				X	X	X	X	34.5
176	X			X	X	X	X	34.0
177	X			X	X	X	X	28.5
178				X	X		X	28.5
179		X	X			X		27.0
180		X			X	X	X	34.0
181	X	X	X					32.0
182			X		X			40.0
183	X		X				X	34.0
184	X	X	X	X	X	X	X	45.0
185	X		X		X	X		32.5
186	X		X				X	28.0
187	X		X					35.5
188	X		X		X			33.5
189		X	X			X		28.0
190	X				X	X		35.0
191			X					27.0
192	X		X		X	X	X	47.5
193	X					X		33.5
194		X			X			26.0
195	X				X			29.0
196	X	X	X	X	X			33.5
197			X		X	X		30.0
198	X				X			26.0
199	X				X		X	21.0
200	X				X			27.0
201			X		X	X		30.0
202	X		X		X			24.0
203		X	X		X	X		29.5

*Perfect score (no restriction) = 19

(3) Pearson Product—Moment correlations were calculated in order to investigate the relationships between variables.

(The reader should be aware that no previously determined levels of significance [alpha] are available.)

Results and discussion

Table 5 gives the mean scores, the standard deviations, and the standard errors derived from the craniosacral examination and the probabilities that the differences in mean scores for each of the 8 categories could have occurred by chance. Categories in which the craniosacral examination score differences were considered to be significant are as follows:

Category 1 (Normal-Not Normal) The probability of the differences in mean examination scores occurring and agreeing with the opinion of the school authorities by chance is less than 1 in 1000 (<.000).

Category 2 (Behavioral Problems)—The probability of the correlation found between school authority opinions and craniosacral examination scores occurring by chance is less than 1 in 1000 (<.000).

Category 3 (Motor Coordination Problems)—The probability of the differences in mean cranial examination scores occurring and agreeing with the Motor Coordination Clinic diagnosis by chance is 2 in 1000 (.002).

Category 4 (Learning Disability)—The probability of the differences in mean examination scores occurring and agreeing with the opinion of the school authorities by chance is less than 1 in 1000 (<.000).

Category 7 (Obstetric Complications)—The probability of the agreement between the presence of a history of an obstetrically complicated delivery of the subject child and the elevation of the mean scores of the craniosacral examination in those children occurring by chance is less than 1 in 1000 (<.000).

The craniosacral examination appears to be valid as a test for behavioral problems, learning disabilities, obstetrically complicated deliveries, and to confirm the opinion of the child's teacher as to whether the child's progress in school is "normal" or "not normal."

Table 6 gives the correlation coefficients (r) between each singular parameter studied during the craniosacral examination and the total score derived from the motion restriction rating of the 19 parameters tested. The (r) and (p) values were computed to determine which of the parameters would most reliably predict high total numerical scores derived from the 19 motion parameters.

There is no apparent significant relationship between total motion restriction of the craniosacral system and the subject's age, height, weight, pulse rate, heart rate, or the rate of the cranial rhythmical impulse. All children were within normal ranges of height and weight.

The most reliable predictors (of the individual motion parameters measured) for the highest total scores have the highest (r) values. Motion Parameter 11 (Compression-Decompression) was the most reliable predictor of widespread restriction within the total craniosacral system as tested. All other parameters of motion were found reliable at probabilities of less than 1 chance in 1000.

The correlation coefficients (r) for all combinations of motion restriction variables (5) and Categories (C) of problems are presented individually and in summation in Table 7. All (r) values presented represent probability (p) values of less

TABLE 5. PROBABILITY OF MEAN CRANIOSACRAL MOTION EXAMINATION SCORE DIFFERENCES FOR EACH OF THE EIGHT CATEGORIZED PROBLEM TYPES.

Category	Frequency	Mean score	Standard deviation	Standard error	Probability
1—"Normal"	165 (82%)	26.05	3.704	0.288	.000
"Not normal"	38 (18%)	31.24	5.736	0.931	
2—Behavioral	32 (16%)	31.30	5.763	1.019	.000
No	171 (84%)	26.22	3.891	0.298	
3—Motor — Speech	34 (17%)	29.19	5.585	0.958	.002
No	169 (83%)	26.59	4.279	0.329	
4—Learning disability	25 (12%)	32.40	5.949	1.190	.000
No	178 (88%)	26.27	3.850	0.289	
5—Seizure history	25 (12%)	27.70	5.429	1.086	.434
No	178 (88%)	26.93	4.495	0.337	
6—Head injury	92 (45%)	27.78	5.086	0.530	.032
No	111 (55%)	26.39	4.097	0.389	
7—Obstetrical complications	67 (33%)	28.78	5.161	0.631	.000
No	136 (67%)	26.15	4.064	0.343	
8—Ear and hearing problems	55 (27%)	27.19	5.592	0.754	.752
No	148 (63%)	26.96	4.211	0.346	

TABLE 6. RELATIONSHIPS BETWEEN TOTAL SCORES AND TESTED SINGULAR VARIABLES.

Singular variable	Correlation coefficient (r)	Probability (p)	
Age	.09	.101	
Height	.08	.128	
Weight	.03	.322	
Pulse rate	.01	.415	
Resp. rate	.05	.233	
CRI. rate	.04	.305	
Motion parameters			
1	.37	<.001	Right occiput restricted
2	.38	<.001	Left occiput restricted
3	.36	<.001	Right temporal restricted
4	.40	<.001	Left temporal restricted
5	.46	<.001	Flexion, restricted toward
6	.45	<.001	Extension, restricted toward
7	.44	<.001	S.B. & R., restricted toward right
8	.42	<.001	S.B. & R., restricted toward left
9	.39	<.001	Torsion, restricted toward right
10	.37	<.001	Torsion, restricted toward left
11	.53	<.001	Compression-decompression, restriction of
12	.39	<.001	Lateral strain, restricted toward right
13	.33	<.001	Lateral strain, restricted toward left
14	.24	<.001	Vert. strain, restricted superior motion
15	.45	<.001	Vert. strain, restricted inferior motion
16	.47	<.001	Sacrum restricted toward flexion
17	.36	<.001	Sacrum restricted toward extension
18	.30	<.001	Sacrum restricted toward right torsion
19	.24	<.001	Sacrum restricted toward left torsion

TABLE 7. RELATIONSHIPS BETWEEN MOTION PARAMETERS (1-19) AND PROBLEMS FOUND IN CATEGORIES (1THROUGH 8)— CORRELATION COEFFICIENTS (r). (N = 205).

Motion restriction variables	Normal not — C-1	Behav. problems C-2	Motor-speech C-3	Learn disabilities C-4	Seizure history C-5	Head injury C-6	Obstetrical complications C-7	Ear problems C-8	Multiple problems Σ C
1—Occiput right	.1793	.1485	.2752	.1546	—	—	.1316	—	.2596
2—Occiput left	—	.1226	—	—	—	—	—	—	.1080
3—Temporal right	.2338	.1710	.1262	.1474	—	—	.2798	—	.2290
4—Temporal left	—	—	—	.1292	—	—	—	—	.0950
5—Toward flexion	.3107	.2080	—	.3052	—	—	.1798	—	.3014
6—Toward extension	.2115	.1683	—	.2336	—	—	—	—	.1515
7—S.B. & R. toward right	.2801	.1696	—	.1877	—	—	.1673	—	.2629
8—S.B. & R. toward left	.1694	.2497	.1745	.2178	—	.1362	—	—	.2571
9—Torsion toward right	.2672	.1812	.1634	.2140	.2005	.1327	.1798	—	.3513
10—Torsion toward left	.2284	.1386	—	.1784	—	—	—	—	.2135
11—Compression — decompression	.2631	.2337	—	.2020	—	.1639	—	—	.2124
12—Lat. strain toward right	—	—	—	—	—	—	.1161	—	.1184
13—Lat. strain toward left	.1676	.1399	—	.1523	—	—	—	—	.1163
14—Vert. strain toward superior	.1708	.1349	.1864	.1470	—	—	—	—	.1949
15—Vert. strain toward inferior	—	.1639	—	.1669	—	—	—	—	.1311
16—Sacrum toward flexion	.2225	.2430	—	—	—	—	.1392		.2413
17—Sacrum toward extension	—	—	—	—	—	—	—	—	.1461
18—Sacrum toward right torsion	—	—	—	.2413	—	—	—	—	.0876
19—Sacrum toward left torsion	.1804	.2519	—	.1538	—	—	.2268	—	.2225
Σ V Total score	.4396	.4019	.2114	.4380	—	.1505	.2687	—	.5014

r ≤ .21 probability is less than .001.
All values given represent probabilities of less than .05.

than .05 (5 chances in 100) of the correlation occurring as a random happening. Correlation coefficients (r) which are equal to or greater than .21 on the table represent probabilities of .001 (1 chance in 1000) or less of the relationship between the examination score and the presence of a problem in that category having occurred by chance.

It can be seen that the total numerical score (Σ) of the 19 motion parameters tested is most significantly correlated with the presence of multiple problems (Σ C). The craniosacral examination would also appear to be reliable in identifying those children whom the school authorities have categorized as "not normal," and those children classified as having "behavioral problems" and/or "learning disabilities." The craniosacral examination also seems an excellent method of determining which children were the products of complicated obstetric deliveries and which children are classified as having motor coordination problems.

Study of restriction patterns as reflected by the (r) values suggests the hypothesis that specific types of problems may be related to certain interdependent motion restrictions and/or restriction patterns of the craniosacral system. Further research of this hypothesis is under way by the author.

Conclusions

1. The use of a standardized quantifiable craniosacral motion examination represents a practical approach to the study of relationships between craniosacral motion restrictions and a variety of health problems which may or may not be related to central nervous function.

2. In general, the accuracy of school authorities' opinions which classify children as "normal" or "not normal" are supported by these data (Tables 3 and 4).

3. The probabilities calculated (Tables 5 and 7) support the existence of a positive relationship between elevated total craniosacral motion restriction scores and classifications of "not normal," "behavioral problems," and "learning disabled" by school authorities, and of motor coordination problems, as diagnosed by the MSU Motor Coordination Clinic.

4. There is a positive relationship between an elevated total craniosacral motion restriction score and a history of an obstetrically complicated delivery (Tables 5 and 7).

5. The total quantitative craniosacral motion restriction score (Σ V) is most positively related to those children presenting with multiple problems (Σ C) on Table 7.

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