Craniosacral Osteopathy's Gift to Children: Cognitive and Neurological Development

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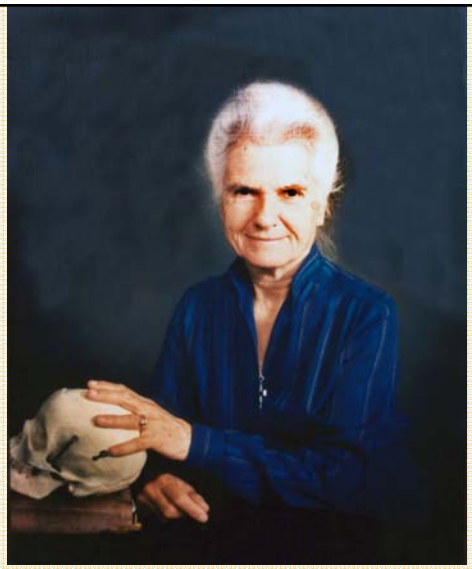
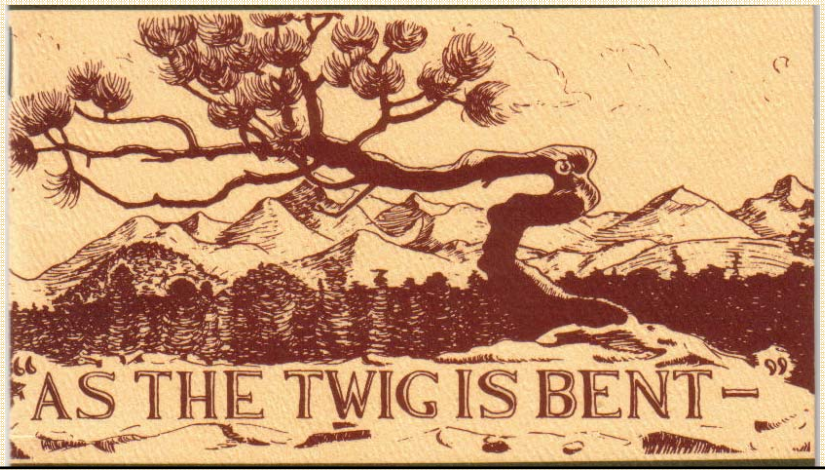


Viola M. Frymann, DO, FAAO, FCA
Continuing the Legacy – Advancing the Dream

"As the twig is bent so doth the tree Incline" – Alexander Pope



From the osteopathic perspective OMT in pediatrics begins at birth……No, actually it begins during pregnancy.

From 1985 to1989 I worked with Viola M. Frymann, DO, FAAO, FCA at the Osteopathic Center for Children in La Jolla, California.

One day I asked how we could reduce the learning disabilities and neurological conditions we were seeing in our patients? She said, "treat the mothers during pregnancy."

Prenatal OMT has become a topic of retrospective research and 2 clinical trials, all supportive of the benefit of prenatal OMT.

Portrait in ATSU-SOMA Foyer

New York Daily News

March 2, 2010

DAILY NEWS/nydailynews.com Tuesday, March 2, 2010 11

Dr. Hugh Dillingen, director of St. Barnabas' osteopathic program, uses his fingers to feel for circulatory or nervous system issues.

THEIR HELPING HANDS

St. Barnabas' caring staff is using special treatment

BY SONDRA HERBERT
PHOTOS BY JEANINE MEDINA

BEFORE BABIES at St. Barnabas Hospital Regional Home, they receive extra hands-on treatment to search for signs of stress in their joints and the physical causes of colic, poor feeding and other newborn problems.

A residency training program at St. Barnabas teaches osteopathic physicians how to gently probe the tiny muscles, ligaments, tendons and connective tissues of newborns for tightness and alignment problems.

"These babies all look fine, but don't feel good because of colic or constipation, when many times their feeding and growth," said Dr. Hugh Dillingen, the program's director.

He said common newborn ailments can be caused by nervous and circulatory system problems. Using osteopathic manipulation, the physicians very gently release tightness and allow the infant's body to align correctly.

Each newborn receives the treatment after the traumatic process of birth. Some infants receive multiple treatments.

Dillingen, who has earned the nickname "magic fingers" at the hospital, said osteopathic manipulative medicine helps the body heal itself and prevents future problems.

Though the procedure is not a massage, it can be relaxing for the tiny tots, he said.

"Sometimes a baby will fall asleep while you are treating them."

Easy to add an osteopathic exam to routine well baby check, even in the hospital.

Plagiocephaly is one of the areas where OMT has a lot to offer.

Dr. Frymann said we had to fix the bent twigs

Frymann V. Relation of disturbances of craniosacral mechanism to symptomatology of the newborn:study of 1250 infants. *JAOA.* 1966;65:1059-1075. **Took 5 years to collect this data.**

TABLE 9. INCIDENCE OF SPHENOBASILAR STRAIN PATTERNS AND SYMPTOMS IN 1,250 INFANTS

Strain pattern of spheno-basilar symphysis	Analysis by dominant strain pattern		Asymptomatic		Jaundice (mongoloid)		Respiratory and circulatory symptoms		Nervous symptoms	
	No. of cases	% of those recorded	No. of cases	% of those recorded	No. of cases	% of those recorded	No. of cases	% of those recorded	No. of cases	% of those recorded
Flexion	124	10.04	68	7.83	1	14.3	11	7.28	44	21.05
Extension	51	4.13	31	3.58	1	14.3	9	5.96	10	4.78
Torsion	352	28.50	262	30.18	1	14.3	55	36.42	34	16.27
Side-bending rotation	150	12.15	111	12.79	1	14.3	16	10.60	22	10.53
Vertical/lateral strain	60	4.86	39	4.49	-	-	6	3.97	15	7.18
Compression	216	17.49	110	12.67	2	28.5	29	19.21	75	35.89
Free	282	22.83	247	28.46	1	14.3	25	16.56	9	4.31
Not recorded	15		6		1		6		2	
Total	1,250		874		8		157		211	

Overall 88% of the 1250 newborns had some identifiable mal-alignment in the form of cranial bone strain patterns.

Birth Trauma - Molding

From the Dept of Neonatology and the Dysmorhology Clinic UCSD Medical Center

Stellwagen L et al. Torticollis, facial asymmetry and plagiocephaly in normal newborns. *Arch Dis Child* 2008;93:827-831.

Stellwagen L et al. 2008

Figure 1 Representative infant photographs: normal (A,B), mild facial asymmetry (C), mild vertex asymmetry (D), moderate facial asymmetry (E) and moderate vertex asymmetry (F).

Arch Dis Child 2008;**93**:827–831. doi:10.1136/adc.2007.124123

Overall, 92% of babies were in the vertex position in utero, 73% were delivered vaginally, and 10% experienced birth trauma. Nearly all babies were described as active, although 36% were described as "stuck" or in the same position during the third trimester. **Seventy-three percent of newborns had at least one asymmetry (10% had more than one)**. Torticollis measuring more than 15 degrees difference in mobility between right and left sides was present in 16% of infants and was most common among babies described as stuck for longer than 6 weeks. **Forty-two percent of infants had facial asymmetry, 62% had asymmetry of the head, and 13% had mandible asymmetry. Facial asymmetry was associated with second stage of labor longer than 60 minutes, forceps delivery, birth trauma, and larger birth size.**

Lessard S, Gagnon I, Trottier N. Exploring the impact of osteopathic treatment on cranial asymmetries associated with nonsynostotic plagiocephaly in infants. *Complementary Therapies in Clinical Practice.* 2011;17:193-198.

Prevalence **nonsynostotic occipital plagiocephaly (NSOP**) skull deformity may occur in nearly 20% of healthy newborns.

Since the American Academy of Pediatrics, in an effort to reduce the incidence of Sudden Infant Death Syndrome, initiated the **"Back to sleep"** campaign in which parents place infants is a supine position for sleep, incidence of **NSOP has increased.** Conventional interventions for NSOP include counter-positioning, physical therapy, and cranial orthosis (helmet therapy).

Lessard et al 2011

Twelve infants referred to the Children's Hospital Trauma Program were the subjects in this pilot study.

Inclusion criteria were, 1) to be younger than 6.5 months at first evaluation, 2) to the diagnosis or the signs of NSOP, and 3) and to have been at term corrected age if born prematurely**.**

Exclusion criteria were 1) if there was a documented craniosynostosis, 2) an ongoing cranial orthosis treatment, or 3) any medical condition judged inappropriate by a physician. The average age of the sample at first OMTh was 4.1 months, 75% were male, 92% had right side head flattening (consistent with current prevalence data) and 83% were vaginal deliveries

Lessard et al 2011

Methods

Each patient received **four osteopathic treatments** of 60 minutes duration **once every two weeks**.

The 3 primary outcome measures used in the assessment of NSOP were the differences between the left side and right side measurements of 1) **Skull Base Asymmetry (SBA**) which is a line from tragus of the ear to the subnasal landmark under the nasal septum, 2)**Cranial Vault Asymmetry (CVA)** which is the distance between the frontozygomatic suture and eurion, the point most lateral on the head in the parietal region, and 3) **Trans-cranial vault asymmetry (TCVA)** which is the diameter frontozygomatic suture around the head to the occipital prominence or flatness.

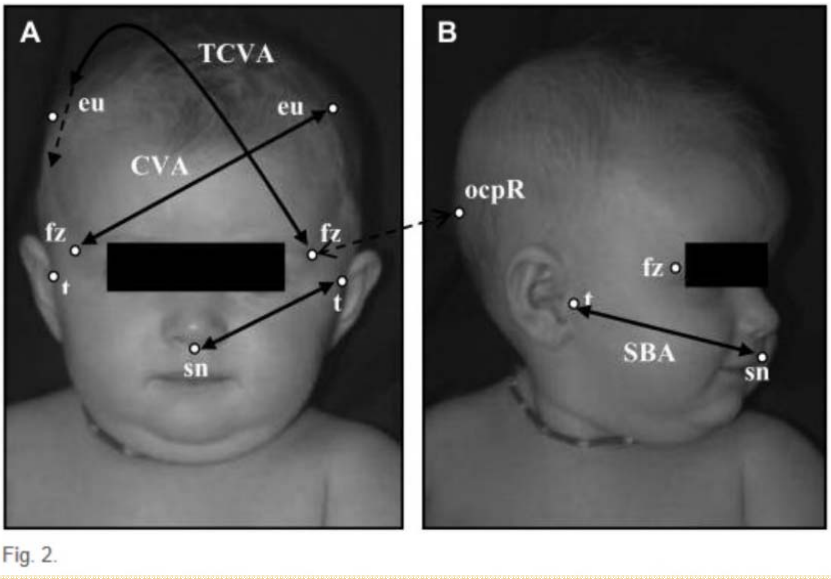


Fig. 2.

Skull Base Asymmetry (SBA) **Cranial Vault Asymmetry (CVA)**

Trans-cranial vault asymmetry (TCVA)

Lessard et al. 2011

The results for all 3 of the primary outcomes measures showed **statistical significance**

CVA (F =5.20; **p=0.02**),
SBA (F=5.72; **p=0.01**),
TCVA (F=7.97; **p=0.003**)

Taken together this showed a significant reduction in skull asymmetry from pre-test to post-intervention, a period of 8 weeks on the average.

The authors note the obvious that, due to the small size and no control group, it cannot absolutely be inferred that the osteopathic intervention was the cause of improved cranial bone symmetry.

In Europe the PT and osteopathic treatment of plagiocephaly has become so popular in the last 10 years that the helmet people express concern

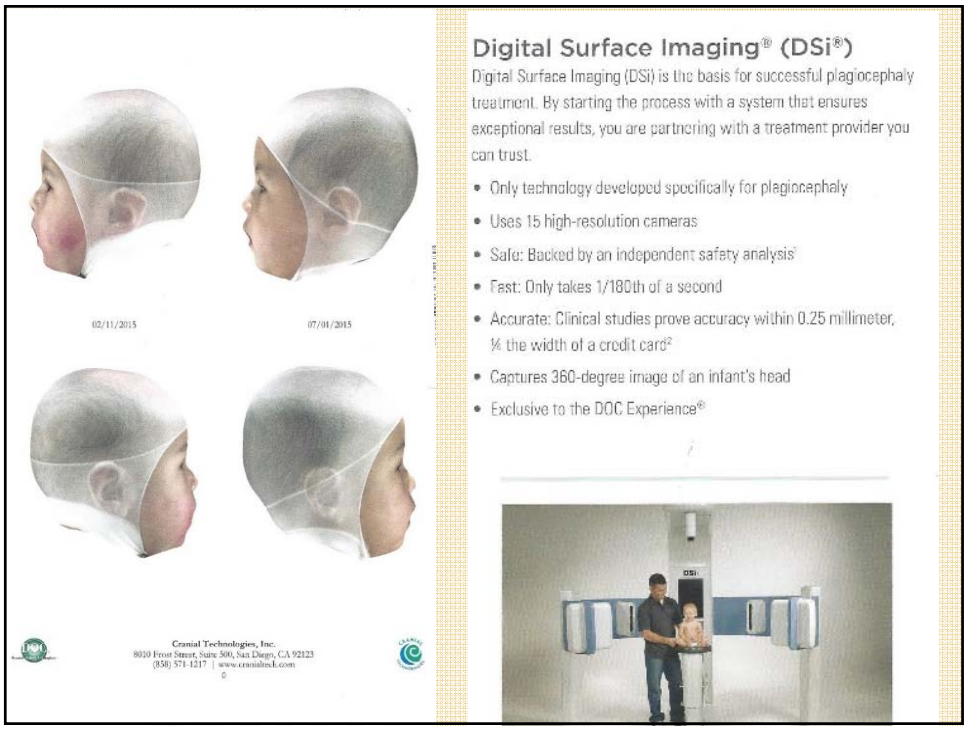
Fig. 2. Child with a helmet.

Kluba S, Lypke J, Kraut W, Krimmel M, Haas-Lude K, Reinert S. Preclinical pathways to treatment in infants with positional cranial deformity. *Int J Oral Maxillofac Surg.* 2014;43:1171-76.

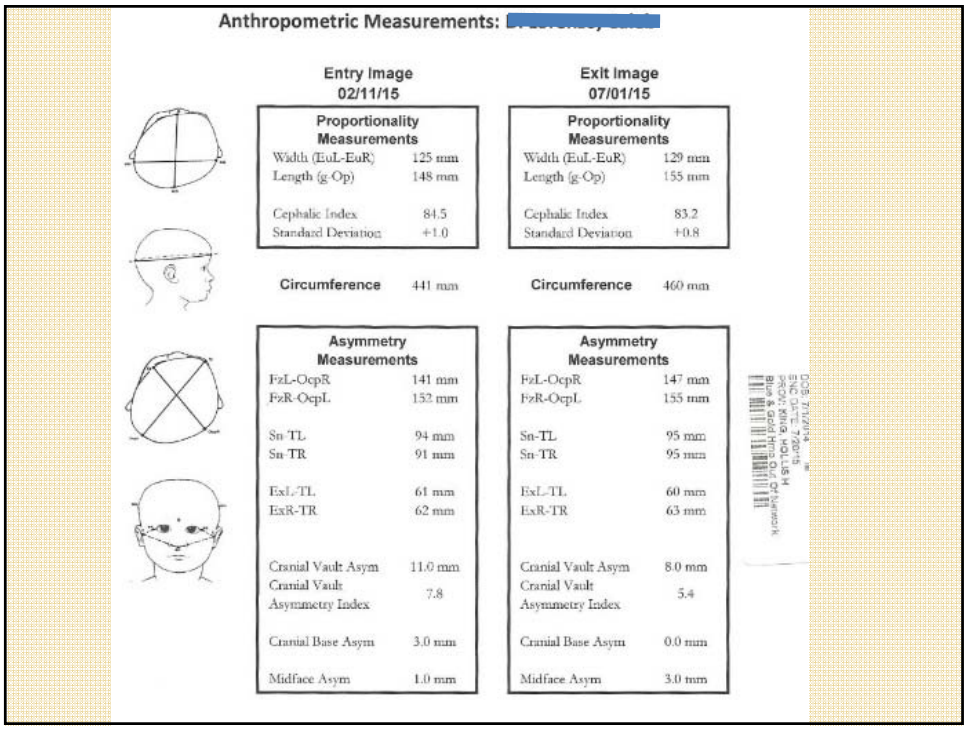
The “preclinical” (quotes due to the authors apparent perspective that everything prior to being seen in their clinic was preclinical even though visits to pediatricians, physical therapist, and osteopaths had already occurred).

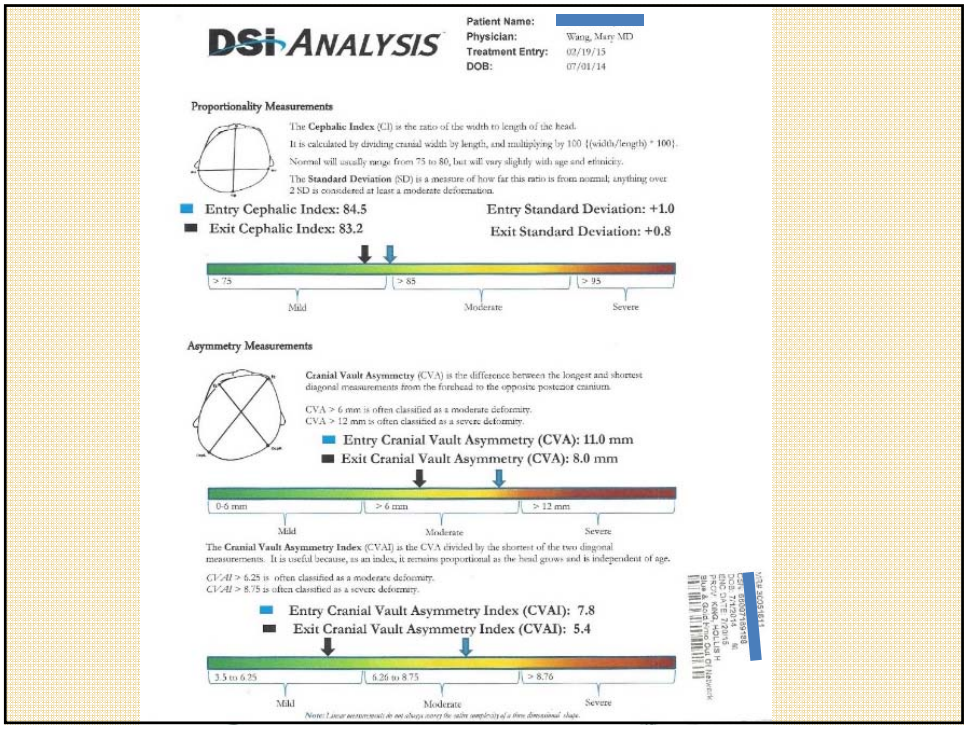
In fact, if the child had been seen for physiotherapy/osteopathy, they appeared significantly later ($P = 0.023$). This implied criticism of physiotherapy and osteopathy is later discussed in the context of the need to **rule out craniosynostosis** by ultrasound examination, which is a service typically done only in oral maxillofacial surgery clinics.

A Recent Case of Mine




DSi ANALYSIS
Patient Name:
Physician: Wang, Mary MD
Treatment Entry: 02/19/15
DOB: 07/01/14
02/11/2015
07/01/2015


Anthropometric Measurements:
Entry Image 02/11/15
Exit Image 07/01/15
Proportionality Measurements
Width (EuL-EuR) 125 mm
Length (g-Op) 148 mm
Cephalic Index 84.5
Standard Deviation +1.0
Circumference 441 mm
Asymmetry Measurements
FzL-OcpR 141 mm
FzR-OcpL 152 mm
Sn-TL 94 mm
Sn-TR 91 mm
ExL-TL 61 mm
ExR-TR 62 mm
Cranial Vault Asym 11.0 mm
Cranial Vault Asymmetry Index 7.8
Cranial Base Asym 3.0 mm
Midface Asym 1.0 mm
Proportionality Measurements
Width (EuL-EuR) 129 mm
Length (g-Op) 155 mm
Cephalic Index 83.2
Standard Deviation +0.8
Circumference 460 mm
Asymmetry Measurements
FzL-OcpR 147 mm
FzR-OcpL 155 mm
Sn-TL 95 mm
Sn-TR 95 mm
ExL-TL 60 mm
ExR-TR 63 mm
Cranial Vault Asym 8.0 mm
Cranial Vault Asymmetry Index 5.4
Cranial Base Asym 0.0 mm
Midface Asym 3.0 mm



DSi ANALYSIS

Patient Name: [redacted]
Physician: Wang, Mary MD
Treatment Entry: 02/19/15
DOB: 07/01/14

Proportionality Measurements

The **Cephalic Index** (CI) is the ratio of the width to length of the head.
It is calculated by dividing cranial width by length, and multiplying by 100 {(width/length) * 100}.
Normal will usually range from 75 to 80, but will vary slightly with age and ethnicity.
The **Standard Deviation** (SD) is a measure of how far this ratio is from normal; anything over 2 SD is considered at least a moderate deformation.

Entry Cephalic Index: 84.5
Exit Cephalic Index: 83.2
Entry Standard Deviation: +1.0
Exit Standard Deviation: +0.8

> 75 | > 85 | > 95
Mild | Moderate | Severe

Asymmetry Measurements

Cranial Vault Asymmetry (CVA) is the difference between the longest and shortest diagonal measurements from the forehead to the opposite posterior cranium.
CVA > 6 mm is often classified as a moderate deformity.
CVA > 12 mm is often classified as a severe deformity.

Entry Cranial Vault Asymmetry (CVA): 11.0 mm
Exit Cranial Vault Asymmetry (CVA): 8.0 mm

0-6 mm | > 6 mm | > 12 mm
Mild | Moderate | Severe

The **Cranial Vault Asymmetry Index** (CVAI) is the CVA divided by the shortest of the two diagonal measurements. It is useful because, as an index, it remains proportional as the head grows and is independent of age.
CVAI > 6.25 is often classified as a moderate deformity.
CVAI > 8.75 is often classified as a severe deformity.

Entry Cranial Vault Asymmetry Index (CVAI): 7.8
Exit Cranial Vault Asymmetry Index (CVAI): 5.4

3.5 to 6.25 | 6.26 to 8.75 | > 8.76
Mild | Moderate | Severe

Note: Linear measurements do not always convey the subtle complexity of a three dimensional shape.

Otitis Media

Mills MV, Henley CE, Barnes LLB, et al. The use of osteopathic manipulative treatment as adjuvant therapy in children with recurrent acute otitis media. *Archives of Pediatrics & Adolescent Medicine.* 2003;157:861-866.

Steele KM, Kukulka G, Ilker CL. Effect of osteopathic manipulative treatment on childhood otitis media outcomes. Poster presented at the *American Osteopathic Association 102 Annual Meeting and Scientific Seminar* 1997 (Oct) grant # 94-12-400.

Steele KM, Carreiro JE, Viola JH, et al. Effect of osteopathic manipulative treatment on middle ear effusion following acute otitis media in young children: a pilot study. *J Amer Osteopath Accoc.* 2014;114(6): 436-447.

Degenhardt BF, Kuchera ML. Osteopathic evaluation and manipulative treatment in reducing the morbidity of otitis media: a pilot study. *J Amer Osteopath Assoc.* 2006;106:327-34.

Mills et al. 2003

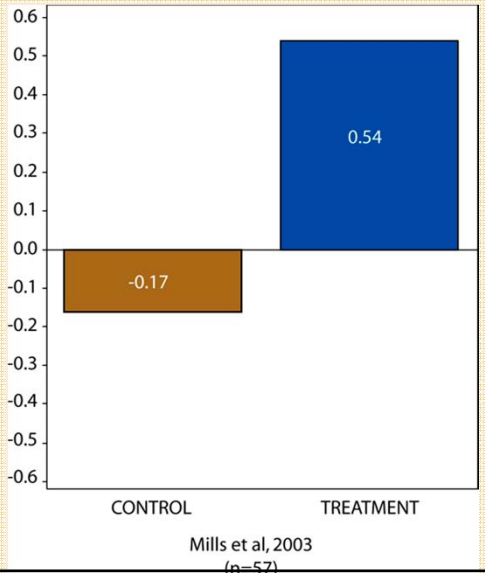
Total Number of Pts= 57 (ages:6 months to 6 years)

32 – Routine Care 25- Routine Care + OMT

OMT Group

1. Fewer Acute otitis media episodes,(mean group difference/month, .14(95% confidence interval, -.027-0.00)P=.04
2. Fewer surgical procedures (OMT=1;Routine=8) P=.03
3. More mean surgery-free months (OMT=6;Routine= 5.25)P=.01
4. More normal tympanograms in OMT group P=.02
5. No adverse reactions reported

Mean Pre/Post Change in Tympanogram Reading



Steele KM, Carreiro JE, Viola JH, et al. Effect of osteopathic manipulative treatment on middle ear effusion following acute otitis media in young children: a pilot study. *J Amer Osteopath Accoc.* **2014**;114(6): 436-447.

Compared standard care only (SCO) and standard care plus OMT (SC+OMT). Patients were aged 6 months to 2 years.

SC+OMT received OMT during 3 weekly visits. Weekly **tympanography** and **acoustic reflectometer (AR)** readings were made on all patients.

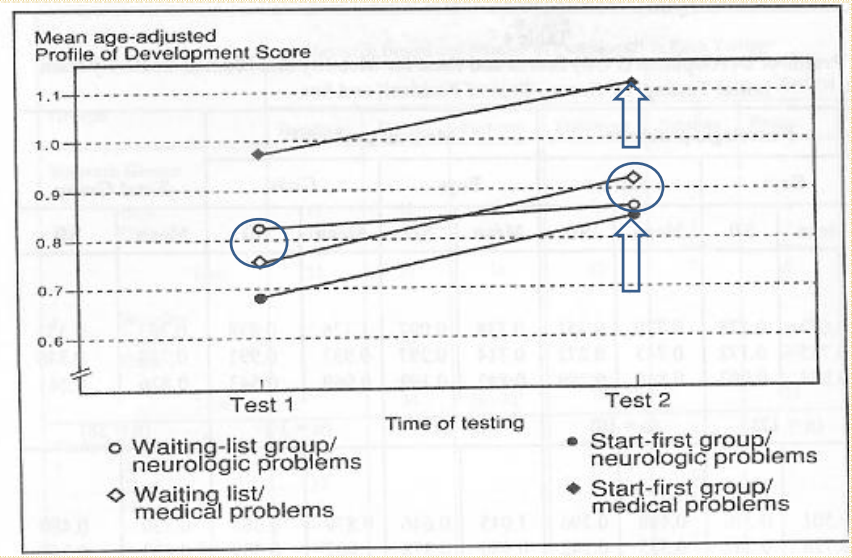
43 patients completed the study.

Results: **Tympanogram data showed a statistically significant improvement in middle ear effusion (MEE) at visit 3 in patients in the SC+OMT group (*P* = .02).**

AR data also significant at visit 3 for SC=OMT (*P* = .02)

Neurological and Cognitive Function Research

Frymann VM, Carney RE, Springall P. Effect of osteopathic medical management on neurologic development in children. *J Am Osteopath Assoc.* 1992;92:729-744.



Frymann et al. 1992

Results

Neurologic performance significantly improved after treatment with diagnosis of neurologic problems and to a lesser degree in children with medical or structural diagnoses.

Frymann V. Learning difficulties of children viewed in the light of the osteopathic concept. *JAOA.* 1976;76:712-20.

- **Group 1** – 74 average or above-average students without visual or learning problems who were treated.
- **Group 2** – 32 average or above average students who had myopia, hyperopia, esophoria, and exophoria but no learning problems.
- **Group 3** – 103 children who were having problems at school because they could not learn in the customary fashion by established standards.

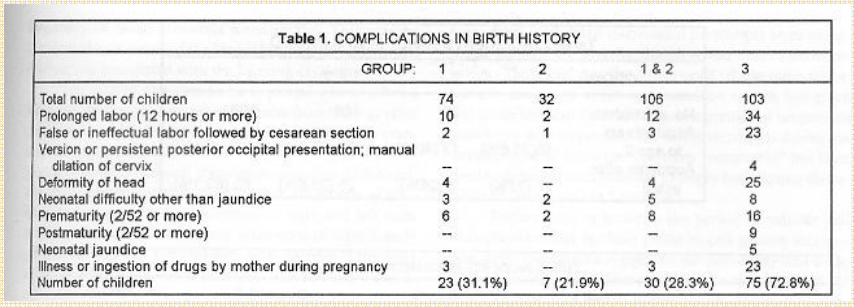


Table 1. COMPLICATIONS IN BIRTH HISTORY

GROUP:	1	2	1 & 2	3
Total number of children	74	32	106	103
Prolonged labor (12 hours or more)	10	2	12	34
False or ineffectual labor followed by cesarean section	2	1	3	23
Version or persistent posterior occipital presentation; manual dilation of cervix	--	--	--	4
Deformity of head	4	--	4	25
Neonatal difficulty other than jaundice	3	2	5	8
Prematurity (2/52 or more)	6	2	8	16
Postmaturity (2/52 or more)	--	--	--	9
Neonatal jaundice	--	--	--	5
Illness or ingestion of drugs by mother during pregnancy	3	--	3	23
Number of children	23 (31.1%)	7 (21.9%)	30 (28.3%)	75 (72.8%)

Frymann 1976

Table 2. ACCIDENTS EARLY IN CHILDHOOD

GROUP:	1	2	1 & 2	3
No. of children	74	32	106	103
Accidents up to age 2	16(21.6%)	13 (40.6%)	29 (27.4%)	31 (30.1%)
Accidents after age 3	17 (23%)	8 (25%)	25 (23.6%)	65 (63.1%)

Table 3. INCIDENCE OF CRANIOSACRAL LESIONS

	Group 3 (103 children with learning problems)		Group 2 (32 children with visual problems)		Groups 1 & 2 (106 children without learning problems)		Group 1 (74 children without visual or learning problems)	
Left torsion	35 (34%)		9 (28.1%)		26 (24.5%)		17 (23%)	
Right torsion	26 (25.2%)		9 (28.1%)		17 (16%)		8 (10.8%)	
Left side-bending rotation	12 (11.7%)		2 (6.3%)		13 (12.3%)		11 (14.9%)	
Right side-bending rotation	28 (27.2%)		8 (25%)		29 (27.4%)		21 (28.4%)	
Lateral strain to left	41 (39.8%)		12 (37.5%)		34 (32%)		22 (29.7%)	
Lateral strain to right	46 (44.7%)		14 (43.8%)		39 (36.8%)		25 (33.8%)	
Alternating lateral strain	2 (1.9%)	86.4%	1 (3.1%)	84.4%	2 (1.9%)	70.7%	1 (1.4%)	64.9%
Vertical strain (superior)	37 (35.9%)		10 (31.2%)		31 (29.2%)		21 (28.4%)	
Vertical strain (inferior)	9 (8.7%)		3 (9.4%)		9 (8.5%)		6 (8.1%)	
Alternating vertical strain	2 (1.9%)	46.5%	0	40.6%	0	37.7%	0	36.5%
Compression	42 (40.8%)		12 (37.5%)		34 (32%)		22 (29.7%)	

Conclusions Frymann 1976

With Learning Difficulties (Group III, N=103)

-72.8% suffered considerable trauma before or during birth

- Head deformity remembered by parents
- Labor>24hrs
- Greater Intensity of learning problems
- Accidents after age 3 were triple that in the other groups
- Severity and frequency was also greater
- No significant differences in particular strain pattern

Conclusions (Cont.) Frymann 1976

- A wide range of strain patterns may be found in children with learning problems as well as in children who do not have a learning disability.

- There is a critical period of susceptibility when strain patterns contribute to the learning disability –up to 2 years of age- this period is opportunity for optimum benefit from correction of such strains.

Frymann VM. The osteopathic approach to the child with a seizure disorder. In King HH. (Ed) *Proceedings of international research conference: Osteopathy in Pediatrics at the Osteopathic Center for Children in San Diego, CA 2002.* American Academy of Osteopathy, Indianapolis, IN, 2005;89-96. **N=87**

Intervention – OMT ala Frymann

Problems During Pregnancy	31
• Premature contractions, bleeding	5
• Fertility program or artificial insemination	3
• Placenta Previa	3
• Gestational Diabetes	2
• Respiratory Infection	4
• Asthma	2
• Prescription Drugs – 2 Thyroid/1Theophyline	3
• Generalized fatigue, stress	2
• Toxemia	2
• Lived in polluted chemical environment	2
• Fibroid	1
• 1 twin died in utero	1
• Intranterine growth delay	1

Table 2.

Problems of Labor	
• Premature	11
• Past due date	7
• 12 - 24 hours	4
• More than 24 hours	6
• Nuchal Cord	3
• Forcep/Suction	8
• Breach, Post-occiput, face	3
• Unterine Inertia	2
• C. Section	13

Table 5.

Results	
• No seizures, no medication	20
• General well being much improved	55
19 Proceeded gradually to less medication	
16 Very rare seizure	
• Did not continue	6
• Improved markedly as small child but behavioral deterioration as teenager 10 years later	1
• No significant change with 6-8 treatments	4
• Progressive Deterioration	1

Cerebral Palsy

Research & Osteopathic considerations

Davis MF, Worden K, Clawson D, et al. Confirmatory Factor Analysis in Osteopathic Medicine: Fascial and Spinal Motion Restrictions as Correlates of Muscle Spasticity in Children with Cerebral Palsy. *JAOA.* 2007;107:226-232.

Figure. *Relationship between osteopathic factors and muscle spasticity. Null model χ^2_{36}=130.59; Satorra-Bentler scaled model χ^2_{25}=32.17 (P=.15); comparative fit index=0.92; root mean square error of approximation=0.07. Numbers shown in parentheses are standard errors.*

Table 2
Fascial and Spinal Motion Restrictions in Children With Spastic Cerebral Palsy: Measurement Models by Restriction Type

Restriction Type	Factor Loading	Regression Coefficient*
■ **Fascial**		
□ Tentorium cerebelli	0.56	0.11
□ Cervicothoracic junction	0.53	0.11
□ Abdominal diaphragm	0.43	0.10
□ Pelvic diaphragm	0.80	0.10
■ **Spinal Motion**		
□ Upper cervical (C1-C2)	0.42†	0.16
□ Lower cervical (C3-C7)	0.23	0.15
□ Upper thoracic (T1-T4)	0.76†	0.14
□ Middle thoracic (T5-T8)	0.29	0.16
□ Lower thoracic (T9-T12)	0.64†	0.13
□ Upper lumbar (L1-L3)	0.06	0.16
□ Lower lumbar (L4-L5)	0.25	0.16

* Standard error
† $P<.05$

Duncan B, McDonough-Means S, Worden K, et al.

Effectiveness of Osteopathy in the Cranial Field and Myofascial Release Versus Acupuncture as Complementary Treatment for Children with Spastic Cerebral Palsy: A Pilot Study.

JAOA. 2008;108:559-570.

Table 3
Hierarchical Regression Analyses for the Effect of OMT and Acupuncture on Outcome Variables of Children in Spastic Cerebral Palsy Pilot Study, Adjusted for Number of Treatments (N=55)

Variable	Treatment Modality, β* OMT	Acupuncture
■ Primary Outcome Variables		
□ GMFCS	-.27	-.31
□ GMFM total percent	.39†	.24
□ PEDI mobility	.26	.20
□ PEDI self-care	.25	.22
□ WeeFIM mobility	.28†	.18
□ WeeFIM self-care	.23	.17
■ Secondary Outcome Variables		
□ DO rating of spasticity	-.44	-.24
□ MAS biceps	.09	.01
□ MAS hamstring	-.13	.08
□ Parent or guardian rating of arched back	-.10	0
□ Parent or guardian rating of startle reflex	-.27	-.22

* The β coefficient represents an estimate of the standardized strength of the effect of a given treatment on an outcome measure, given as the number of SD units per one SD unit of change in number of treatments, with other variables held constant (ie, pretreatment score, age, months from baseline to final assessment).
† $P<.05$

Abbreviations: DO, osteopathic physician; GMFCS, Gross Motor Function Classification System; GMFM, Gross Motor Function Measurement; MAS, Modified Ashworth Scale; OMT, osteopathic manipulative treatment; PEDI, Pediatric Evaluation of Disability Inventory; WeeFIM, Functional Independence Measure for Children.