INFANT AND CHILD CHIROPRACTIC CARE:
An Assessment of Research

Anthony L. Rosner, Ph.D.

FCER

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FOREWORD

It is unfortunate that one of the more recent challenges confronting the chiropractic profession is chiropractic treatment for infants and children. Recent challenges in Canada have shown the extent to which our detractors will go in attempting to limit the reach of chiropractic care. We should take this challenge seriously and respond by educating the public about what we can do for children.

Part of educating the public is to investigate the existing literature on the conservative management of children for a wide range of conditions. While chiropractic manipulation is obviously part of what chiropractors do in rendering care to children, it is certainly not the only thing. Many conditions would be treated similarly by both chiropractic and medical physician. It is important to note that as primary care providers both disciplines train their doctors to make appropriate diagnostic and therapeutic decisions regarding patient care. As example, the wonderful text "Pediatric Chiropractic" by the Australian chiropractor Neil Davies (1) is an extensive treatise on the diagnosis and management of children, based largely upon the reading of hundreds of papers on hundreds of topics. The information is there to justify the use of conservative interventions in those conditions.

Where there is less evidence is in the use of manipulation for treatment. We are all aware of the historic impediments the chiropractic profession has faced with regard to research: marginalization, lack of access to research funds, lack of access to hospital settings, an at-times uncritical attitude, etc. These have made it difficult for the profession to create the research infrastructure necessary to expand the documentation of care we currently enjoy. This will change as the profession increases its training, its "market" impact and its research enterprise.

Dr. Davies notes that the strength of his book lies in the fact that it approaches care from the perspective of limitation; that is, of providing excellent information regarding diagnosis, with emphasis upon knowing when to refer for medical or other care (Davies NJ. Personal communication, May 9, 2002). This is a critical point. As the profession develops interdisciplinary relations with medicine and other healthcare providers, as we strengthen our role as primary-care providers, there is a need to know when to say when, to know at what point the patient exhibits findings that suggest care is rendered by some other provider. Our philosophy must never come before the needs of our patients.

At the outset of this foreword, I noted that we must educate the public about what we do. We should do so based upon the evidence. Dr. Rosner has done exactly that in this monograph.

Dana J. Lawrence, DC

REFERENCES

1. Davies NJ. Chiropractic pediatrics. Edinburgh: Churchill Livingstone, 2000.

INFANT AND CHILD CHIROPRACTIC CARE: AN ASSESSMENT OF RESEARCH

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INFANT AND CHILD CHIROPRACTIC CARE

The late Past President of the American Public Health Association Helen Rodriguez-Trias was among the first to recognize the importance of chiropractic care of infants and children. As a Fellow in the American Academy of Pediatrics and former Director of Pediatrics at the Lincoln Hospital in New York City, she indicated in her Foreword to a new textbook on chiropractic care for children that she accepted her invitation to write this treatise with both gladness and trepidation. Gladness because she firmly believed that chiropractic fundamentally promotes health for children ; trepidation because as a pediatrician she had been indoctrinated to totally reject chiropractics and chiropractors, and who overcame prejudice and fear only two decades ago through my own direct experience. [1]

It is with gladness and deliberate rationality without trepidation with which FCER firmly supports both the theory and practice of chiropractic care for children in many aspects of healthcare delivery. Our position arises from both the rationale for such care and promising results in much of the recent research over the past 20 years which demands further attention in the spirit of conservative, noninvasive and effective care. For chiropractic management, patients in a compelling number of studies have expressed emphatic satisfaction,[2-8] supported by copious emerging evidence regarding both safety[9] and effective outcomes.[10] Furthermore, it is reasonable to search for alternative methods of pediatric care in situations in which medical alternatives are found to have significant risks, as will be outlined below.

THEORY:

According to Biedermann,[11] children in their development are subjected to two formidable challenges to their musculoskeletal system. The first is the trauma of passage through the birth canal, one of the most dangerous passages to be traversed in a lifetime according to a variety of sources, mostly obstetricians. Here it appears that intracranial structures of apparently healthy newborn individuals display a high percentage of indications of microtrauma of brainstem tissues in the periventricular region,[12] and it is believed that exposed structures of the occipito-cervical junction suffer at least as much as the cranium.[13] In summary, it appears that injury to both the intracranial and subcranial structures is the rule rather than the exception.[11] The second major onslaught to the child s emerging musculoskeletal system occurs when the infant has to master the transition from a quadriped to a biped, mastering the task of maintaining an upright spine in learning how to walk. Superimposed upon this burdensome task is the fact that the last major growth spurt usually occurs between the ages of 11 and 13, after which time both the complaints and treatment regimens of such individuals become congruent with those of adults.

Prior to that time, the infant is both highly susceptible to developmental irregularities that may exert a lifetime influence if not properly attended to; by the same token, the same individual is highly receptive to conservative forms of corrective treatment. This leads to an essential piece of information regarding manipulative therapy for small children: As pointed out by Biedermann, it is ***not*** a scaled-down version of the procedures used for adults.[11]

PRACTICE:

Manipulation of children appears to date from at least 1727, at which time Nicolas Andry coined the term Ortho-Paedics to depict straightening the young and became the defining principle of the medical procedures that he published.[11] The goal of all interventions is to alleviate or eliminate perceived asymmetries in spinal structure, posture or gait as well as reduce symptoms for a variety of conditions which will be described below. No adjustment is ever prescribed without evidence of a relative decrease in mobility at a particular articulation.

Examination procedures preceding the adjustment include static or motion palpation. It has been suggested by some that radiography may be useful to assess asymmetries and confirm the direction of the impulse to be applied.[11] According to Anrig,[14] the elastic properties of the developing spine require that vectors which would introduce extraneous forces into the spine [such as from mobilization or long-lever contacts] should be kept at a minimum. Nonspecific maneuvers which are discouraged include supine, prone or seated rotary break, hyper lateral flexion and rotation, longitudinal traction, extension, flexion, and extension. Instead, the increased flexibility of the child s spine often results in a preload tension that is greater than that experienced adults, followed by a high acceleration thrust considerably gentler than that applied to adults, a deceleration period and 1-2 second holding period to increase the effectiveness of the adjustment. Especially with infants, specific contacts are made more often through the fingertips rather than the hypothenar or pisiform applications experienced with adults. Craniosacral procedures primarily limited to non-force indirect methods have also been recommended and implemented.[15] Finally, extensive attention to nutritional matters including counseling in matters related to vitamin and mineral intake, balanced diets, and food allergies has long been a component found in most chiropractic practices.[16]

RESEARCH:

While not as extensive as for adults, the literature which exists for childhood outcomes is compelling in its own right. In a few instances [otitis media, colic, asthma] as will be shown below, the side effects of standard medical treatments have been adverse enough to spur searches for alternative methods of treatment, and in many instances the clinical practice of chiropractic has produced enough encouraging results to not only warrant further research but the continuation of the clinical practice as well. Unlike the adult literature, relatively little data yet exists on outcomes, satisfaction or cost-effectiveness of treatment with regard to back pain, neck pain or headache in infant, child or adolescent populations.

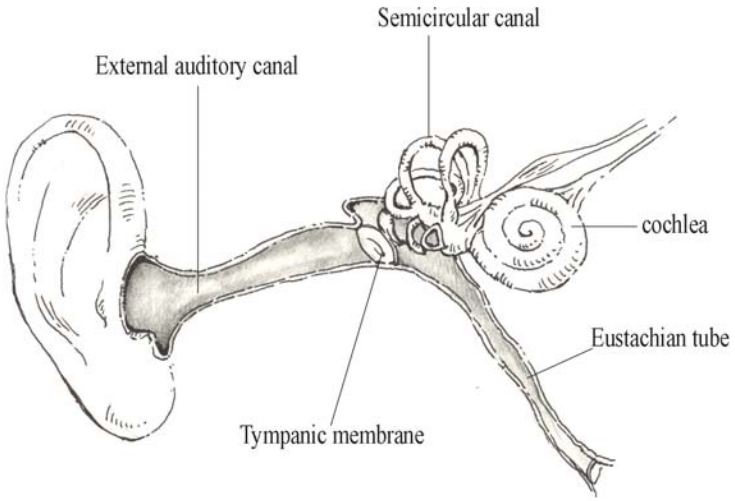
Otitis Media:

A. Rationale:

The approach to managing otitis media should begin with understanding the function of the eustachian tube. Collection of either clear or purulent fluid in this region is the identifying characteristic of otitis media. Therefore, the crux of treating otitis media would logically be the drainage, opening

and closing of this tube. As shown in **Figure 1**, this function is primarily regulated by the tensor veli palatini muscle which in turn is innervated by the trigeminal nerve.[17,18] Secondary regulation of the tube might also be affected by the levator veli palatini and salpingopharyngeus muscles. Misalignment of the C1 vertebra and/or occiput, affecting components of the superior cervical sympathetic ganglion, would be expected to influence, in turn, the tonus of the tensor veli palatini muscle, the vagus nerve, the inferior vagal ganglion, and ultimately the levator veli palatini, salpingopharyngeus, and superior constrictor muscles. All these sequelae would be presumed to lead to the undesirable construction or closure of the eustachian tube. Treatments such as manipulation in an effort to alleviate this vertebral misalignment would therefore appear to be the most direct and attractive possibility.[19] The other major fact to consider is the case against the premature and indiscriminate use of medical alternatives in treating otitis media.

Figure 1
CROSS-SECTION OF THE MIDDLE, INNER AND OUTER EARS



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B. Risks of Medical Alternatives:

ANTIBIOTICS:

As medical practices evolve with our increasing knowledge as well as a changing environment, so must the advisability of using antibiotics as a first line of treatment for otitis media. To continue the indiscriminate use of such medications in the face of mounting evidence constitutes significant health risks to both the individual patient and the population as a whole. Prescribing antibiotics without even examining the patient is particularly problematical. There are at least 5 reasons to seriously question the use of antibiotics as a first line of treatment for otitis media:

1. A significant percentage of otitis media cases are not even caused by bacteria:

   According to numerous studies outlined by Schmidt, anywhere from 20-40% of otitis media cases in which the middle ear fluid has been cultured fail to yield bacterial strains in culture.[20] One would therefore deduct that these represent otitis media cases caused by either virus-

es or sterile effusions both of which ***by definition*** would not be expected to ever respond to antibiotics. Strong support for this conclusion has been recently provided by Pikaranta, who demonstrated that ***viruses without pathogenic bacteria*** were found in the middle ear fluid of the majority of samples taken from children with otitis media with effusion.[21] Should fluid cultures not be obtainable, examination of the ear by otoscopy and/or tympanometry[22] would be expected to yield clear indications of the etiology of the ear infection, helping to segregate those cases which ***theoretically*** would be amenable to treatment with antibiotics. The remainder of otitis media cases would have no chance of responding to antibiotics, making their prescription without the direct examination of the patient untenable.

2. Widespread use of antibiotics for any condition could lead to calamitous bacterial resistance:

The remarkable ability of bacteria to develop resistance to antibiotics is well-documented. This would include [i] enzyme mutations which allow bacteria to inactivate beta-lactam drugs, [ii] development of intracellular pumps to remove antibiotics before they can destroy the host cell, [iii] cell wall protein changes which block antibiotics from entry, and [iv] synthesis of substitute proteins which escape the lethal effects of antibiotics.[23] To make matters worse, antibiotic resistance may be transferred via plasmids from a resistant bacterial strain to a nonresistant strain that is not even the same species.[23] Among clinical isolates of some bacterial species, strains resistant to all available antibacterial agents have been identified.[24] Simply put, each time an antibiotic is used there is the risk that a resistant mutation may develop and proliferate meaning that the use of antibiotics does not come without a price. Increasing populations of multidrug resistant bacteria from 1995-1998 have been extensively described within the U.S.[25]

The consequences of this problem for the world s population could be disastrous. The increased morbidity, mortality, and costs of worldwide resistance of bacteria to antimicrobial drugs is already a matter of record.[26] Both the Institute of Medicine in the United States in 1992[27] and the Centers for Disease Control in 1994[28] have warned of this growing threat. Remedies linked to a global plan of the World Health Organization[29] include the request to educate parents to avoid asking for antimicrobials when they are not useful and to urge that physicians prescribe them conservatively.[30]

The indiscriminate use of antibiotics appears to have risen to abusive levels. In a lead editorial published within the past year, The International Herald Tribune suggests that a major health problem in developed countries is the over-utilization of drugs, including the fact that the Centers for Disease Control estimates that one-third of antibiotics taken on an outpatient basis in the United States are unnecessary. Should we continue to use antibiotics at our present level, protection will not be available 50 years from now since almost every major infectious disease is becoming resistant to currently available medicine.[31]

The problem becomes even more acute when one considers otitis media. According to Ambrose Evans-Pritchard, the situation is described as follows:

In the U.S., there are 24.5 million doctor-visits a year by children with ear infections. They are typically given antibiotics, and in many cases they care kept on a constant, low dosage course for the whole winter. U.S. parents expect no less. But we now know that there is price to

be paid for this: more people will die of pneumonia, which is treated with variants of the same drugs. A quarter of all cases of ***streptomyces pneumoniae*** in the U.S. are now resistant to known drugs, compared with 0.002 per cent a decade ago.[32]

In this regard, it is important to note that in The Netherlands, where a waiting period of 1-2 days is routinely observed before antibiotics are given for otitis media, occurrence of antibiotic resistance is 1%, compared to the 25% level in the U.S. where antibiotics are given immediately.[33] A 1992 study suggested that more than 90% of the colds and respiratory tract infections for which antibiotic prescriptions were written for adults were ***viral*** in origin, rendering these antimicrobial drugs ineffective. In fact, it was suggested that antibiotics are overprescribed by 50% in the United States and Canada.[34]

The take-home message from all the previous arguments would be that antibiotics should be considered as a ***later*** [instead of a first] resort.

3. Side-effects have been linked to the use of antibiotics for otitis media:

By destroying bacteria, antibiotics may wreak havoc upon beneficial species as well as those presumed to be causing harm. A perfect example would be their disruption of the ecological balance of intestinal flora. In so doing, the bacteriocidal effects of antibiotics might be expected to allow proteins which are normally blocked from adsorption to pass through the intestinal wall, leading to what is commonly known as a leaky gut syndrome. In so doing, antibiotics could allow foreign proteins to be introduced into the bloodstream, leading to the raising of antibodies and the creation of allergic responses within the host[20]

A recent report is disturbing in that it suggests that there is an increased risk of asthma symptoms with antibiotic use. Specifically, the odds ratio for the risk of asthma rises to 2.7 if antibiotics were ever used, and this risk increases to over 4 if antibiotics were used in the first year of life. Furthermore, the risk increases from 2.3 with 1-2 courses of antibiotics to over 4 if 3 or more courses are used, making the risk appear to be dose-dependent.[35] This phenomenon [an association, not a causation] could well be explained by the aforementioned leaky gut phenomenon, in which allergic responses could be manifested by the constriction of bronchial airways and the resulting development of asthmatic symptoms.

A further complication with antibiotics is suggested by the work of Jochen Schacht at the University of Michigan. Animal studies have shown a profound hearing loss [61 db auditory threshold shift at 18 kHz] in guinea pigs receiving gentamicin, possibly due to a free-radical mechanism of toxicity of aminoglycoside antibiotics[36] which destroys hair cells in the cochlea and the lower turns of the outer ear.[37]

All of this once again suggests that the use of antibiotics does not come without consequences, several of which are unwanted, detrimental, and ultimately preventable if antibiotics are not used inappropriately.

4. The effectiveness of antibiotic use in treating otitis media has been questioned in the literature:

Within the past decade, a reevaluation of a major clinical trial, a second clinical trial, and a meta-analysis all question the effectiveness of amoxicillin in managing middle-ear effusions.

The reevaluation suggested that the antibiotic was not effective[38] and the meta-analysis suggested that to prevent one child from experiencing pain by 2-7 days after presentation, 17 children must be treated with the antibiotic early [suggesting only modest benefits].[39] The remaining clinical trial not only echoed the findings of the meta-analysis but went so far as to suggest that this modest effect does not justify prescription of antibiotics at the first visit, provided close surveillance can be guaranteed.[40]

One would imagine that, given this weak evidence regarding the capacity of the routine use of antimicrobials to decrease the duration and severity of otitis media, there should be cries for a revision of this policy. Indeed, requests for such reassessments have appeared recently in the scientific literature,[25] including a review and plea from the International Primary Care Network.[41]

5. <u>The basis for prescribing antibiotics for pediatric problems is not necessarily based upon scientific principles</u>:

To compound the problem of prescribing antimicrobials to treat nonbacterial conditions as suggested in item #1 above, a recent report suggests that when physicians merely ***thought*** that the parent wanted antimicrobials to treat their children s illnesses, physicians were significantly more likely to give a bacterial diagnosis.[42] The link between patients expectations and physicians prescribing responses has been extensively documented in the literature.[43-46] Patients do seem to expect antibiotics for prescriptions, and their satisfaction rises when these expectations are met.[47] What is remarkable in these studies is how physicians ***diagnostic capabilities*** as well as their prescriptive responses appear to have been influenced by their perceptions of patients attitudes.

The question that one would pose in this circumstance is as disturbing as it is elementary: Are sound scientific principles being followed in the current paradigm of prescribing antibiotics?

To conclude, a substantial body of literature now exists to refute the contention that antibiotics should be prescribed as a first line of defense for the treatment of otitis media. It is only through the education of both patients and physicians that one would hope that more efficient, less expensive, and especially less invasive means are developed to manage the patient with otitis media.

<u>TYMPANOSTOMY</u>:

In certain instances with persistent otitis media with effusion, tympanostomy tubes have been inserted through the eardrum to attempt to reduce hearing loss caused by the accumulation of fluid or to attempt to lessen the frequency of recurrent bouts of otitis media. In 1988, some 670,000 surgeries were performed in the United States, making it the most common operation for children.[48-50]

It would appear that puncturing the eardrum by such an intervention should be a means of last resort. Potential complications of tube insertion would include prolonged otorrhea, persistent perforation of the tympanic membrane, and scarring of the tympanic membrane which may be associated with

low-grade, long-term hearing loss.[48-53] The results from a variety of epidemiological studies have not been encouraging: one study found that one quarter of tube insertions for children were proposed for inappropriate indications and another third for equivocal ones,[54] while another indicated that for children younger than three years of age with persistent otitis media, prompt tympanostomies did not measurably improve developmental out-comes.[55]

C. Evidence Supporting Spinal Manipulation as a Treatment Alternative:

An examination of the current data regarding spinal manipulation for the management of otitis media offers substantial encouragement for the continuation of this alternative as a treatment option. Although data are not yet available from clinical trials, a sizeable number of patients reported in case studies shown in **Table 1** offer encouraging [though not definitive] evidence supportive of chiropractic management. The data suggest that the majority of otitis media cases treated with spinal manipulation appear to be resolved within 10 days, most resolving with fewer than 5 adjustments[22,57] and many requiring only one or two treatments.[19,56] Particularly intriguing is the fact that patients with no history of prior ear discomfort were much more likely to show early improvement.[56] Normalization of otoscopic and tympanographic results likely occurred more quickly in cases of acute rather than chronic otitis media.[22,57]

Mastoiditis [the chief complication of otitis media] occurs only 0.2-2% of the time, even without antibiotic treatment;[58,59] it behooves the physician to not only consider spinal manipulation as a treatment option for otitis media, but as a possible ***first*** alternative in light of the more rapid responses achieved in acute cases.

Clearly, this strategy serves the patient well also in avoiding the complications attending the medical options discussed above. In none of the studies reported in **Table 1** were any side effects or complications reported.

TABLE 1

SUMMARY OF LEADING OUTCOMES STUDIES INVOLVING SPINAL MANIPULATION FOR MANAGING OTITIS MEDIA

AUTHOR	DESIGN	#SUBJ.	AGE	INTERVENTION	OUTCOMES	RESULT
Froehle[56]	Cohort	46	≤5 yr	A SMT SOT AK	Parental decision	93% ep improved
Fallon	Case series	332[22] 401[57]	≤5 yr	RF D, G SMT STE	Otoscopy Tympanography	Resolved Resolved
Phillips[19]	Case	1	23 mo	A SMT	Ear drainage, pain	Reduction

A = Activator
SOT = Sacro-occipital technique [occasionally]
AK = Applied kinesiology [occasionally]
RF = 3° rotation, 5° lateral flexion
D = Diversified
G = Gonstead
STE = Soft tissue effleurage
ep = Episodes

Infantile Colic:

First described in 1894 as dyspepsia, infantile colic has most recently been described as the unexplainable and uncontrollable crying in babies aged 0-3 months for more than 3 hours per day, more than 3 days a week, and more than 3 weeks. Some studies have described flexing of the knees against the abdomen with clenching of the fists and extension of the trunk or extremities.[60] Although the condition has been regarded to be self-limiting and benign, its effect upon parent-child relationships can be construed to be stressful if not damaging.

To buttress years of promising clinical observations, a number of interventions have recently been conducted [**Table 2**],[60-64] all with results either statistically or trending toward promising. All involve spinal manipulation either applied by fingertip or a computer-assisted solenoid adjusting device. What is most dramatic is the comparison shown with the surfactant dimethicone, which not only produced a considerably lesser effect from 5-10 days after the start of treatment, but showed worsening of symptoms as was apparent in 7 of the medicated group of patients.[60] While the effects of manipulation compared to a hand-held placebo group did not appear to differ statistically, a trend toward superiority in the numbers of patients affected is apparent. Furthermore, greater numbers of the manipulated group indicated some or marked improvement.[61] Other explanations as to why the latter study did not reveal a statistically significant effect in contrast to the former [in addition to their uses of different control groups] are the following: [i] the infant s mother was blinded; [ii] the former study required infants to cry for more than 3 hours for 5 of the previous 7 days rather than for 3 days per week in the previous 3 weeks; [iii] the intervention in the former study was slightly more intensive [3-5 adjustments over 14 days as opposed to 3 adjustments over 8 days]; and [iv] the latter study required two additional criteria for colic, which could have screened out individuals who displayed an enhanced response in the former investigation. A pilot randomized clinical trial suggested that complete resolution of symptoms could be found in 93% of the subjects undergoing up to 6 treatment sessions over a 2-week period.[62] **What remains unclear is whether Olafsdottir[6] adjusted areas of the spine that were different from the other two investigations,[60,62] accounting for the differences in results.**

TABLE 2

SUMMARY OF LEADING OUTCOMES STUDIES INVOLVING SPINAL MANIPULATION FOR MANAGING INFANTILE COLIC

AUTHOR	DESIGN	#SUBJ. AGE	INTERVENTION	OUTCOMES	RESULT
Wiberg[60]	RCT	25 4-6 wk 20	F SMT Dimethicone	Crying [hrs]	70% drop in 5 days 20% drop in 5 days
Olasfdottir[61]	RCT	32 3-9 wk 24	F SMT Held 10 min	Symptom scale	Improvement in 70% Improvement in 60%
Mercer[62]	RCT	15 0-8 wk 15	SMT Detuned ultrasound	Parent diary	93% resolved, 2 wk
Klougart[63]	Cohort	316 1-5 wk	F SMT	Crying [hrs]	75% drop in 14 days
Leach[64]	Case	2 6-9 wk	I SMT	Crying [hrs]	50% drop after 1-4x

F = Spinal manipulation applied with light fingertip pressure
I = Instrument [PulStar FRAS Sense Technology, Inc.]
x = Number of treatments

While spinal manipulation is usually associated with the treatment of musculoskeletal disorders, these data create two possible interpretations. As indicated by Wiberg,[60] either spinal manipulation has been shown to be effective in the treatment of a visceral disorder or infantile colic is, in fact, a musculoskeletal disorder rather than the visceral condition it is assumed to be. In either case, these data provide a further basis to continue the use of spinal manipulation in treating specified pediatric conditions.

Nocturnal Enuresis:

Another childhood condition causing great distress to children and parents alike is enuresis, or bedwetting. In the absence of urological and neurological pathology, this condition has been described as having multifactorial origins.[65] It has been proposed that spinal joint dysfunction could disrupt the integration of somatic, spinal, parasympathetic and sympathetic nerve pathways constituting a significant contribution to the patient s enuretic condition. Thus a few clinical studies have appeared in the literature[66-68] and suggest more than not that spinal manipulative therapy might play a useful role in managing this condition [**Table 3**].

While the majority of cases did not appear to respond in one of the studies,[67] it was felt that more information could have been obtained in the presence of a control group given a sham procedure in a randomized controlled trial. In that particular study, the manipulated group did indeed display a significant improvement over its own baseline values while the placebo group did not. However, the mean pre- to post-treatment night frequency group for the test group compared with that of the control group was not quite statistically significant at the 5% level.[67] A larger sample size would most likely have created a statistically robust difference between the groups. In addition, despite its miniscule n of 1 design, Gemmell s study displayed a time-series improvement following manipulation which defied the natural course of improvement.[68] The one trial that did indicate improvement utilized an adjusting technique developed at the Palmer College of Chiropractic.[69]

TABLE 3

SUMMARY OF LEADING OUTCOMES STUDIES INVOLVING SPINAL MANIPULATION FOR MANAGING NOCTURNAL ENURESIS

AUTHOR	DESIGN	#SUBJ. AGE	INTERVENTION	OUTCOMES	RESULT
Reed[66]	RCT	31 8-11 yr 15	P SMT Sham	Wet nights/2 wk	16% < baseline 0% < basline
LeBoeuf[67]	Cohort	171 4-15 yr	SMT	Wet nights/wk	75% no response
Gemmell[68]	Case	1 14 yr	T SMT	Dry/damp/wet	Trend to dryness

P = Spinal manipulation, Palmer Package Adjusting Technique[69]
T = Spinal manipulation, Toggle Recoil
Sham = Activator at nontension setting

Asthma:

As the most common chronic disease of childhood,[70] asthma has increased in its prevalence more than 50% and in mortality more than 70% since 1980.[71] Its control by medication is primarily through antiinflammatory agents [inhaled steroids] or beta-2-agonists [bronchodilators], the last of which when used excessively may actually contribute to an increase of mortality and morbidity.[72] There has thus been a shift toward using antiinflammatory agents; at the same time, questions have been raised as to whether alternative and less invasive means are available for controlling this condition.

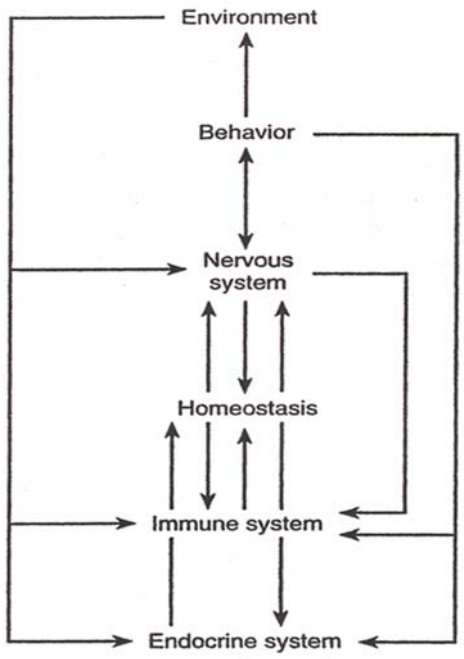
Spinal manipulation has been proposed as an option primarily for two reasons. The first is that vertebral dysfunctions assumed to underlie chiropractic management could produce reflex irritations of the somatic and autonomic nervous system; second, from both a neurological and biomechanical point of view, chest-wall function or bronchial airway tone and/or responsiveness might be expected to be adversely affected by such a lesion leading to a increased risk for an asthmatic attack.[73] Reduction or elimination of these joint aberrations might thus be expected to reduce the incidence of asthmatic events.

A second and perhaps central element to keep in mind is the stress response in the asthmatic. In the at- tempt to maintain homeostasis, bronchial hyperresponsiveness is the defining characteristic in asthma. What has been ignored for too long until very recently in asthmatic research is the role of the endocrine system; in particular, glucocorticoid secretion from the adrenal cortex in response to adrenocorticoid secretion from the anterior lobe of the pituitary. The role of the adrenal secretions in stress was first described by Hans Seyle in 1936,[74] the connection between stressful events and increased cortisol levels being subsequently described.[75-77] The role of the hypothalamic-pituitary-adrenal [HPA] axis as the means by which close communication is established between the central nervous system, the immune system, and hormones and the means by which this is related to stress and chiropractic has been elegantly presented by Morgan[78] and is depicted in **Figure 2A**, while **Figure 2B** indicates in more detail how corticosteroids are produced.[79] The point of this discussion is that interventions which control stress may have a significant palliative effect in the management of asthma, with cortisol appearing to be an important marker.

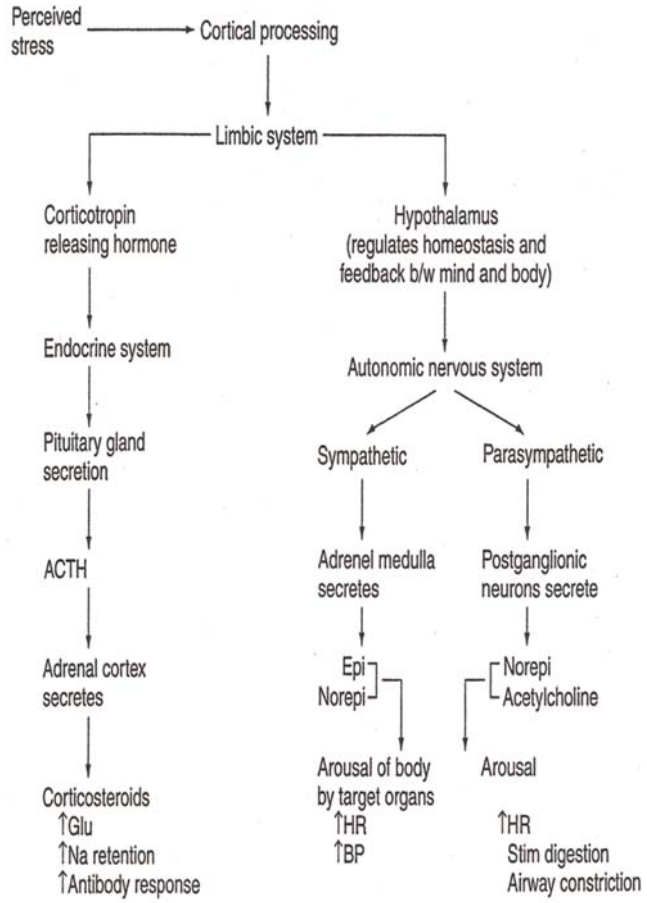
In terms of actual asthma management, there are some indications from randomized clinical trials that such interventions as acupuncture, yoga, hypnosis, and relaxation are beneficial as adjunctive measures in the management of chronic asthma.[80] A particularly elegant study by Tiffany Field has demonstrated that two groups of asthmatic children, aged 4-8 and 9-16, displayed profound changes in pulmonary functions, attitude and behavior scores, and cortisol levels following ***massage*** as compared to a noncontact control group.[81] The significance of this particular control group needs to be noted and will be revisited shortly.

In addition to descriptive or anecdotal data which have reported a positive clinical effect of spinal manipulation for asthma,[82,83] two randomized clinical trials and a cohort study as shown in **Table 4** offer qualified support for spinal manipulative therapy in the management of this condition. Lung function improvements per se may not be detectable,[84,85] but quality of life scores improved by 10-28%, led by activity scale changes.[85] The largest randomized clinical trial to date which is attempting to compare different manipulative techniques in the management of asthma is currently underway in

FIGURE 2
STRESS RESPONSES



A. Interaction with Various Body Systems[78]



B. Psychoneuroendocrine Stress Responses

Figure 2A
Reprinted from Journal of Manipulative and Physiological Therapeutics.
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Australia; although data on symptoms, quality of life and distress are forthcoming in this study, preliminary cortisol measurements indicate that with manipulation [as opposed to simply visiting the treatment center], levels do decrease.[86] Immunoglobulin A, on the other hand, appears to increase in patients attending chiropractic centers;[86] this result is particularly noteworthy in that transient deficiences of mucosal and salivary IgA have been shown to lead to the development of bronchial hyperresponsiveness and asthma.[87]

The apparently negative study appearing in The New England Journal of Medicine, stating that the addition of chiropractic spinal manipulation to usual medical care for four months had no effect on the control of childhood asthma, requires further comment. This statement was based upon the failure of active and sham-manipulated patient groups aged 7 to 16 years to be differentiated in terms of their outcomes in both quality of life and airway function. What is indisputable is that there were major improvements from baseline to followup observed in each of the groups.[84] The problem arises when one considers what was actually done in the sham procedures. Prolonged applications to no less than 3 distinct anatomical areas [gluteal, scapular, cranial] to the patient were described. Admittedly, these were not high-velocity contact procedures, but this appears to obscure an important phenomenon. Two pieces of evidence strongly suggest that simple contact with patients through sham procedures may produce significant effects in terms of asthma relief. The first indicates that, with respect to the reflexive inhibition of the alpha-motoneuron pool in human subjects, sham and active manipulative proce-

dures display little difference. This is to suggest that cutaneous receptors, muscle spindles, and joint mechanoreceptors individually or in concert are significantly affected by so-called sham procedures.[88] The second arises from the studies of Field[81] described above, in which low-force massage as opposed to ***no contact*** was sufficient to elicit a differential, beneficial response in over-coming asthma symptoms. This more than anything else should indicate that physical contact with the patient is sufficient to trigger a cascade of physiological changes which Balon erroneously dismissed in the asthma study.

In this particular condition, the reader must take note that chiropractic extends beyond high-velocity, low amplitude adjustments. It encompasses a broad range of both high-velocity and low-force techniques together with ancillary procedures, many of which have obviously been embedded in the sham procedures described. In its attempt to craft a fastidious design, the Balon trial appears to have missed the forest for the trees by attempting to portray the essence of chiropractic care as the lack of differentiation between the sham and manipulated experimental groups.

TABLE 4

SUMMARY OF LEADING OUTCOMES STUDIES INVOLVING SPINAL MANIPULATION FOR MANAGING ASTHMA

AUTHOR	DESIGN	#SUBJ. AGE	INTERVENTION	OUTCOMES	RESULT
Balon[84]	RCT	38 7-16 yr 42	D SMT +S Sham	PEF FEV QOL	Small rise No change Improved
Bronfort[85]	Cohort	22 6-17 yr 12	SMT Dr	PEF FEV QOL Severity Symptoms	N.S. change N.S. change Significant rise Significant drop No change
Ali[86]	RCT	150	C c h w	AQ SF-36 DASS Cortisol IgA	 SMT decreases Centers increases

D = Spinal manipulation, Diversified
S = Soft tissue techniques
Dr = Spinal manipulation with drop table
PEF = Peak expiratory flow
FEV = Forced expiratory volume
QOL = Pediatric Quality of Life Questionnaire
C = Treatment at centers
c = Nontreatment at centers
h = Nontreatment at home
w = Nonsymptomatic patients at home
AQ = Asthma questionnaire
DASS = Depression and anxiety stress scale

Retrolisthesis and Scoliosis:

As shown by **Table 5**, very few outcome studies have yet been conducted regarding these conditions with no clinical trials for comparison to the natural progression of curvatures observed in scoliosis. Reductions in retrolisthesis were apparent among the 49 consecutive chiropractic patients sampled in Plaugher s investigations.[89] While Lantz cohort study did not yield apparent changes after interven-

tion,[90] questions have been raised as to its methodology; in particular, [i] the inclusion/exclusion criteria of patients, [ii] dropouts, [iii] changes in subgroups that may have been overlooked, and [iv] whether there was sufficient statistical power to draw the conclusions reported. While cessation of back pain in scoliotic patients has been reported in case studies involving older patients,[91] this outcome has yet to be evaluated in children and adolescent populations. The other outcome which needs to be systematically evaluated is whether the ***progression*** of curvature observed in scoliosis is to any significant extent retarded or halted by chiropractic intervention.

TABLE 5

SUMMARY OF LEADING OUTCOMES STUDIES INVOLVING SPINAL MANIPULATION FOR MANAGING SCOLIOSIS

AUTHOR	DESIGN	#SUBJ.	AGE	INTERVENTION	OUTCOMES	RESULT
Plaugher[89]	Case series	49	NS	G SMT	Retrolisthesis	34% reduction
					Sacral base angle	No change
					Cervical lordosis	No change
					Cobb's angle	No change
					Scapular base angle	No change
Lantz[90]	Cohort	42	6-12 yr	D, G SMT Heel lifts Postural counseling Lifestyle counseling	Cobb's angle	No change

G = Gonstead
D = Diversified

Neurological Disorders: Epilepsy, Autism, Attention Deficit/Hyperactivity Disorder:

Given that the activation of neuronal receptors in the spine might lead to vagus nerve stimulation, known to have antiepileptic effects,[92] it is conceivable that spinal manipulation could limit seizure spread in a particular region of the brain. Numerous case reports of positive effect of manipulation abound in the literature, with one study indicating positive results in all 15 patients administered upper cervical manipulation,[93] and others pertaining to favorable outcomes in individual children.[94,95]

A variety of encouraging responses of children with autism having undergone an assortment of manipulative interventions have also been reported.[96,97] Finally, reversal of symptoms associated with attention-deficit hyperactivity have been reported from several children undergoing chiropractic adjustments, with or without nutritional supplements.[98,99] While these are clearly harbingers to spur further, more rigorous research efforts, the reader must bear in mind that the level of evidence for these neurological disorders is at the present anecdotal only, nor are spinal manipulations yet indicated to replace current and more widely accepted means of treatment. The fact remains that observations such as these warrant further investigation rather than being categorically barred for childhood conditions which

remain refractory to conventional medical treatment. It is only with closer investigation that particular strengths and limitations of ***any*** proposed healthcare intervention, including chiropractic healthcare, may be properly assessed.

Headache:

The topic of pediatric headache has been explored in clinical research with a handful of case studies and case series, a fraction of which have appeared in the peer-reviewed journals. As shown in **Table 6**, tension-type, cervicogenic, and even migraine headache have been described with positive outcomes,[100-105] the most recent study meeting the precise diagnostic specifications of the International Headache Society for cervicogenic headache and employing a variety of chiropractic techniques with an 8-year old patient. The authors indicated that the mechanism of action of spinal manipulation in the management of cervicogenic headache remains obscure, either improving the range and/or quality of motion in the neck or simply reducing the source of pain in the cervical spine.[105]

TABLE 6

CHIROPRACTIC TREATMENT OF PEDIATRIC HEADACHE

Author	n	Age[yr]	Diagnosis	Diagnostic Procedues	Adjustive Procedures
Haney[100]	1	11	Subluxation	X-ray, AK muscle	Diversified
Hewitt[101]	1	13	TTH	Passive MP	Diversified
Kastner[102]	12	Unspecified	TTH, M, U	Unspecified	Unspecified SMT
Cochran[103]	1	10	M	X-ray, MP	Thompson, diversified
Anderson-Peacock[104]	5	6-15	CEH [2] M [3]	ROM, xray, MP	Diversified
Lisi[105]	1	8	CEH	ROM, MP	Diversified Modified rotary break Side posture mamillary push Myofasical release

Legend: CEH, cervicogenic headache; M, migraine headache; TTH, tension-type headache; U, unspecific; ROM, range of motion, AK, applied kinesiology; MP, motion palpation; SMT, spinal manipulative therapy.

CONCLUDING REMARKS:

This survey of the rationale and some of the leading evidence for the chiropractic management of specific childhood conditions presents a convincing argument for the continuation of such treatments for the immediate future. What is both immediately apparent and puzzling from the foregoing discussion is that for populations younger than 21 years of age, there have not yet been any outcome studies regarding spinal manipulation and back pain, despite the wealth of such studies in adult populations[106] and the fact that back pain has become the condition most frequently associated with chiropractic

care.[107] This is particularly perplexing in light of the fact that point and 1-month prevalences of back pain in childhood and adolescent populations have been shown to be surprisingly robust, occurring between 12-39% as shown in Table 7.[108-112] Clearly, this is a population in which the results of manipulation need to be studied in further detail.

A similar situation holds for headaches. Despite the multiplicity of outcome studies for adults[113-117] which have gained recognition in a study conducted by Duke University and endorsed by the U.S. Agency for Health Research and Quality,[118] there have not yet been formally constructed manipulation trials with pediatric populations. As for back pain, headache prevalences in children are remarkably high, having been reported to be as elevated as 80-90% over the past year in schoolchildren[119,120] and even at nearly 15% for children 6 years of age[121]

Issues regarding childhood vaccinations have been capably summarized elsewhere[122] and are beyond the scope of this discussion. The same situation applies to childhood birth trauma.[123]

Evidence from many different types of experimental designs [basic and clinical, the latter comprised of randomized controlled trials and cohort and case studies] has been emerging at a rapid rate over the past two decades and provides a promising basis with which to consider chiropractic management for such childhood conditions as otitis media, colic, enuresis, asthma, and various neurological disorders. Denial of this treatment represents no less than the suppression of important medical information [which in at least one state has been ruled to be a form of medical negligence[124]]. Because the frequency of side effects associated with spinal manipulation has been reported to be exceedingly low[9] our continued use and further inquiry into the more detailed aspects of this type of therapy does not appear to constitute any particular health risk to the patient certainly not any greater and decidedly less than some of the medical side-effects reviewed in this discussion.

In our review of child healthcare based upon evidence, it is interesting to note that the dosage rates of ***medications*** in allopathic medicine for children are routinely calculated from body surface areas, merely representing scaled-down versions of the adult formularies.[125,126] Direct evidence from outcome studies involving medications and children appears to be lacking. In striking contrast are the manipulative procedures given to children, which as Biedermann had stated at the beginning of this report are

TABLE 7

PREVALENCE OF BACK PAIN IN PEDIATRIC AND ADOLESCENT POPULATIONS

NATIONALITY	AGE	PREVALENCE [%]
United States[108]	13-16	30.4
United Kingdom[109]	Adolescent	11.5
United Kingdom[110]	11-14	24*
Switzerland[111]	Schoolchildren	27
Denmark[112]	8-10; 14-16	39*

All figures represent point prevalence unless shown with an asterisk (*), indicating 1-month prevalences.

not at all simply proportional reductions of the techniques applied to adults.[11] From the evidence at hand, therefore, excluding chiropractic management as a treatment option for infants and children would seem to egregiously violate the over-arching principle of providing meaningful risk/benefit ratios of treatment alternatives to the patient, which should be the hallmark of any credible and viable medical practice.

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The Foundation for Chiropractic Education and Research

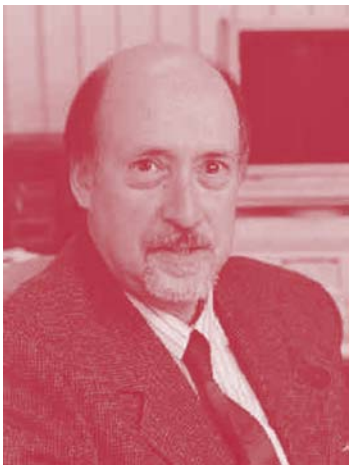
Since 1944, the Foundation for Chiropractic Education and Research (FCER) has endeavored to fund and support scientifically sound research to evaluate chiropractic health care. In order to protect the integrity of the research that it funds, FCER maintains a 501 (C) (3) status as an independent research foundation, dedicated to education and research.

The standards to which FCER-funded studies are held are uncompromising and designed to withstand the scrutiny of the scientific community. The Foundation is responsible for funding numerous clinical trials and other studies investigating the efficacy and cost-effectiveness of the noninvasive method of health care.

Foundation for Chiropractic Education and Research

Administrative Offices: 380 Wright Road
Norwalk, IA 50211
800-622-6309

Research/Education Offices: 1330 Beacon Street, Suite 315
Brookline, MA 02446-3202
888-690-1378



BIOGRAPHICAL SKETCH:

Dr. Rosner has brought to FCER a unique confluence of backgrounds in research design, clinical chemistry, and grants and academic administration. His thesis work at Harvard [1966-1972] and postdoctoral work at the NIH, spliced by a 4-month visiting research sabbatical in molecular biology at the Centre National de la Recherche Scienifique in Gif-sur-Yvete, France, brought him into contact with many of the world s leading researchers involved in enzyme regulation and bacterial physiology [1972-1974]. Overcoming initial opposition from more traditionally oriented medical researchers, he then successfully applied the concepts of allosteric enzyme regulation to the cytoplasmic estrogen receptor and, with grants from the NIH and National Science Foundation, was able to provide substantial new information relating to the mechanisms of action of estrogen in both normal and neoplastic breast tissue [1975-1983].

His medical research then grew into his directing two clinical laboratories at Beth Israel Hospital, a teaching facility of Harvard university in Boston. One of these laboratories was the generally clinical chemistry lab at the hospital, responsible for the testing of nearly a quarter of a million patient specimens annually. In less than a year, Dr. Rosner provided successful methodologies for 95 new clinical assays and promoted what had been a specialized laboratory into a regional reference center, increasing its early income over tenfold. After his nine years at Beth Israel [1974-1983], Dr. Rosner took over the directorship of laboratories of a facility which was an affiliate of the Mayo Clinic, responsible for the testing of patient specimens annually from 150 area hospitals. In this post, he continued his clinical research directed at the role of estrogen receptors in breast cancer, presenting his results and the accomplishments of the laboratory at both international and domestic meetings of professional societies [1983-1986].

As Department Administrator in Chemistry at Brandeis from 1986-1991, he was responsible for the day-to-day leadership in a department with a rotating chairmanship. Within the department, he oversaw all phases of staffing, teaching, space, and grant application, expenditures, and reporting. His management of up to 80 accounts by his refinements of encumbered accounting systems virtually eliminated overexpenditures and the demand for his procedures in other departments and institutions. He also successfully directed the design, budgeting, and renovations of research and teaching space comprising 30,000 sq ft and was a major influence in the successful acquisition of over $2M in grants, contracts and accounts at all institutions listed in his dossier since 1975.
In 1992, Dr. Rosner chose to bring all these elements of his past by joining the Foundation of Chiropractic Education and research as its Research Director. His interest in chiropractic research stemmed from its unique blend of biochemical, biomechanical, statistical, psychological, and epidemiological studies evident within the field, while at the same time providing a means of patient care far less invasive or costly than surgery or medication. He has been then and now the potential for growth to be spectacular accommodating many diverse backgrounds and interests with fewer potentially restrictive central dogmas. Such was the state of molecular biology in the early 1950 s, drawing heavily upon the talents of physicists as well as chemists and biologists. With strong backgrounds in both the benchwork and administration of both medical biochemistry and clinical chemistry, he has maintained that such a nascent, accommodating, and promising field as chiropractic research would be an especially challenging and rewarding one.

At FCER, Dr. Rosner has directed and reviewed over 50 programs in both basic and clinical research pertaining to chiropractic care, primarily headed by principal investigators at colleges, universities, medical centers, think tanks and other clinical centers world wide. He has assessed and defined the priorities of chiropractic research, communicating these to both applicants and prospective sources of funding. This has entailed performing periodic site visits and presenting FCER s background and objectives worldwide, including Canada, Australia, Japan, the United Kingdom, Denmark, The Netherlands, Switzerland, France, Italy, Austria, and the Czech Republic as well as all across the United States. This has included his visiting nearly 20 chiropractic colleges in these locations.