ORIGINAL RESEARCH

# Vertebral Subluxation Correlated with Somatic, Visceral and Immune Complaints: An Analysis of 650 Children Under Chiropractic Care

*Ogi Ressel BSc, DC, DACBR(C), FICPA[†] and Robert Rudy BSc, DC, FICPA[††]*

**ABSTRACT**

**Background:** We evaluated children and their neuromuscular, biomechanical, neuro-homeostatic development and patterning in order to gain some insight into the perplexing problem of health attainment. We describe the nuances and effects of a new subluxation pattern seen in children - the Pelvic Distortion Subluxation Complex (PDSC). We feel that the PDSC is responsible, partially or fully, for a number of adaptive neurological patterns and kinesiopathological reflexes that can propagate a myriad of conditions - these seem to arise in childhood and plague individuals into adulthood. The authors maintain that PDSC is an entity amenable to correction - thereby restoring homeostasis.

**Objective:** It is the author's contention that many, if not the preponderance of conditions seen in adults, have their origins in the childhood years. The objective of this paper is to describe a new subluxation pattern seen in children - the Pelvic Distortion Subluxation Complex which we found to be a common denoninator in many children's health issues.

**Methods:** We examined children of varying ages, varying complaints, and varying levels of health expression. All children in the study were chosen randomly and were patients of our Centre. All examinations were performed by 6 staff doctors with pediatric certification from the International Chiropractic Pediatric Association. The initial sample consisted of 677 children. 27 were excluded for the following reasons; No pelvic information was available, child was under the age of two, child was over the age of 18. Our final sample consisted of 327 boys and 323 girls. Analysis of examination findings, radiology, Surface Electromyography and Infrared Thermography was statistically evaluated. We took 5 parameters of complaints disclosed by children (or mentioned by their parents) and arranged them according to the class of complaint; a. Somatic b. Visceral/ Autonomic c. Behavioural d. Immune e. Other. All data was arranged according to three age groups; a. 2-4, b. 5-12, c. 13-18, and was also categorized by sex and total scores.

**Results:** The preponderance of PDSC is to present with a left pelvic fixation and a corresponding right hypermobility. We have found that 96% of all children seem to possess, and be subjected to the effects of the Pelvic Distortion Subluxation Complex. The PDSC was a common denominator in complaints plaguing our sample of children. These are summarized into a percentage of the total sample and the most common complaints of children in our study are mainly of a somatic nature with some visceral and immune components.

**Conclusion:** The process of neurological learning or programming of the central nervous system with respect to locomotion, posture, proprioception, and body kinetics begins within a few short months after birth. Our study revealed a pattern of pelvic dysfunction correlated with numerous somatic, visceral and immune complaints. These dysfunctions should be discovered as early as possible in a child's development to effect a correction and the relationship between these dysfunctions and ill health should be further studied.

**Key words:** *Chiropractic, Pelvic Distortion, Scoliosis, Spinal Degeneration, Asthma, Ear Infections, Headaches, Enuresis, Low Back Pain, Neck Pain, Growing Pains, Constipation, Croup, Colic, Fatigue, Hyperactivity, Learning Difficulties, Allergies, Fever, Homeostasis, Biomechanics, Subluxation, Dysponesis.*

**Introduction:**

A noted researcher, writer, lecturer and friend, Dr. Christopher Kent, stated that we are in the midst of a revolution in health care. A study supporting this observation, published in the *Journal of the American Medical Association*, reports that people are seeking health care which is "congruent with their own values, beliefs, and philosophical orientations toward life and health."[1] People see health as very elusive, whereas disease and sickness seem commonplace. In order to attempt to explain this phenomena, we decided to look to children and their development for possible clues to this puzzling scenario.

Chiropractors who deal with children have reported that many, if not the preponderance of conditions seen in adults, seem to have their origins in the childhood years; that sickness is often the result of childhood aberrations of physiology - a

[†]Coach, The Practice Evolution Program, Milton, Ontario, Canada
[††]Private Practice of Chiropractic, Peterborough Ontario, Canada

state of dysponesis.[2] It was Edison many think, who stated *"As the twig is bent, so grows the tree"*.

One of the objectives of this paper is to introduce the reader to a subluxation pattern observed in children - the *Pelvic Distortion Subluxation Complex*. The adult version of this distortion has enjoyed some time and allegiance of other researchers in the past however this subluxation pattern in children, although touched on by papers in the past, has rarely been applied to understanding the pathophysiology, the dynamics, and the neurophysiology of patterning in children and their particular neuro-spinal development.

Another purpose was to correlate the effects of this new subluxation construct into a configuration that revealed a pattern. We feel the implications of what we found are far reaching. This paper is the culmination of a study of 650 children.

**Methods**:

We examined children of varying ages, varying complaints, and varying levels of health expression. All children in the sample chosen are patients of our Centre. This ensured uniformity of examination protocols, electro-diagnostic testing, radiology, subsequent care, and follow-up. Our sample consisted of 327 boys and 323 girls. Analysis of examination findings, radiology, Surface Electromyography, Infrared Thermography, was statistically cross-referenced and noted.

We used the Insight 7000 Subluxation Station® in our electrodiagnostic testing. We must emphasize that this was a random sample - children were not hand-picked specifically to fit the parameters of the study, rather the method used was sequentially congruous. The initial sample consisted of 677 children however 22 were excluded for the following reasons;

**a.** No pelvic analysis information was available
**b.** Child was under the age of two
**c.** Child was over the age of 18

We took 5 parameters of complaints disclosed by children (or revealed by their parents) and arranged them according to the class of complaint;

**a.** Somatic
**b.** Visceral/Autonomic
**c.** Behavioural
**d.** Immune
**e.** Other

All data was arranged according to three age groups;

**a.** 2-4
**b.** 5-12
**c.** 13-18

And we looked at sex and total scores.

Considerable time was devoted to scoliosis and/or spinal curvatures, as well as any incidence of radiologically identifiable spinal degeneration in the above age groups - as these seem to be the most capacious adaptive results of the PDSC seen in practice. All examinations were performed by six staff chiropractors of the Centre, all possessing Pediatric Certification and Fellowship through the International Chiropractic Pediatric Association (ICPA).

**Pelvic Distortion Subluxation Complex**

It is our intent to present the field practitioner with a new construct of a subluxation - the Pelvic Distortion Subluxation Complex (PDSC). The name was chosen for it encompasses the sum total of the physiological, neurological, mental, and biomechanical effects of this entity on the growth, development, functional adaptability, and neuro-patterning of a child.

It was Illi and Johnston who first demonstrated that normal biomechanics of the pelvic apparatus was a prerequisite for normal homeostasis of the body.[3,4] This abnormal function of the sacroiliac mechanism produced excess expenditure in energy utilization, inefficient postural adaptation, and somato-visceral efferents with a common viscero-somatic return.[5-20]

In order to appreciate the efferent pathophysiology produced by PDSC and the effects on somatic economy, one must first have a good understanding of normal pelvic function. Many authors have dealt with gravitational adaptation as the precursive stressor which has paved the way for development of spinal curvatures, etc. The development of normal spinal curvatures, functional postural kinetics and spinal neurobiomechanical efficiency is not solely dependent upon proper adaptation to gravity however. It is also dependent upon exact and proper function of the base of support for the spine - the pelvis.[3-23] In fact, these causative factors are difficult to separate into two distinct entities as they are very much interdependent.

As early as 1940, a biomechanical model of pelvic function was proposed, later authenticated by other researchers, and centered on the concept that sacroiliac articulations are freely moveable and have very exact functions. Certainly Logan Basic, Thompson, and Sacro-occipital techniques have as their core, pelvic balance and integration. Of the vertebrates, man is the only species with freely moveable sacroiliac joints.[2,5,21]

It was then discovered that these articulations, while different in the nature of their movement and range, are true diarthrodial joints but with a different microscopic composition on either side of the sister articulation.[22] These joints appear smooth in fetal life, only to become lined with ridges, wedges, and irregularities as chronological age advances. These are early indicators of abnormal pelvic stresses and adaptive compensatory reflexes. It is interesting to note that while these articulations are primarily employed in the stress of weight transfer and load-bearing, the associated muscular components are used mainly for stability. The main function of the pelvic musculature it seems, is not to generate motion but rather to stabilize the pelvic mechanism for effective load transduction - the process of transfer of both elastic and gravitational forces between pelvic components in kinetic motion. Thus the sacroiliac articulations can be assumed to be large mechanoreceptors located in the centre of considerable force streams being transferred by the pelvis from the upper body to the lower limbs. Further, these articulations are essentially ground into shape according to impulsive loading and learned kinetics and their ligamentous apparatus shows adaptations to strong long-time stresses.[23-41]

In the model as proposed by Illi a number of years ago, sacral function can be likened to that of a gyroscope opposing the movements of the corresponding ilia during locomotion and other complex movements.[3] These antagonistic movements of

the sacrum always keep the center of gravity in proper vertical and horizontal planes according to the needs of body effort and economy. Thus the center of gravity is not only always to be found in the center of the supporting structures, but also at the exact varying height that the extent of normal locomotion and gait mechanics specifies for. This biophysical adaptation results in a posturally and functionally efficient pelvis and biomechanically sound lumbosacral interface.[5,34]

It was determined that the integrity of this complex biophysical mechanism is not only vital to efficient locomotion, but owing to the manifold duties it has to perform, it is absolutely fundamental to the general health of the individual. A dysfunction within this mechanism could mean:

1. Additional demands on body economy which lead to fatigue, muscle exhaustion, chronic neurological distress, etc.
2. A loss of aesthetic posture by alteration of gait and body movement with a general loss of body harmony and orchestration.
3. Interruption of the line of gravity and the shifting of body weight disproportionately on a single spinal supporting segment, causing compensatory spinal curvatures and vertebral subluxations, all of which produce articular strain with resultant inflammatory changes leading to early osteoarthritis, and a cascade of other adaptive effects.
4. Aberrant proprioceptive impulses affecting a variety of muscle spindle mechanisms establishing learned and programmed kinesiopathology with a loss of tone.
5. Aberrant vasomotor reflexes affecting the recurrent meningeal systems with resultant overflow to both visceral and somatic pools.
6. Referred pain, radiculitis, radiculopathies, as well as other adaptive reflex mechanisms.[5]

As can be readily seen, proper pelvic biomechanics are a prerequisite for correct development, function, and most importantly, learning of the neuromuscoloskeletal system. Often however, the mobility of the sacroiliac articulations can lead to instability, biomechanical distortion, kinesiopathologic states, postural dysfunction and neurodysfunctional abnormalities.[3,6,8,13,14,42]

A subluxation anywhere in the pelvic structure can undermine normal biomechanical patterns, creating a *biomechanical distortion* of the pelvic unit. Such a situation can adversely affect spinal function, creating multiple subluxation complexes at other sites of the spine which may be identified as distal to the initiating irritant. Adaptive scoliotic spinal curvatures for example, are most often the result of chronic aberrations in pelvic mobility and are created as a compensation for a posturally inefficient state.[5] Lewit identified these aberrations early in 1973 when he stated that as many as 40% of children exhibit such abnormalities of pelvic motility.[43] Illi's findings were similar.[3] The data from our study points to nearly 100 % of children displaying these abnormalities.

In order to have a more realistic comprehension of the developmental implications if these biodysfunctional lesions are allowed to persist, one must realize that such dysfunctions within the neuromuscoloskeletal system well as their consequential soft tissue histopathology, encroach upon the intervertebral foramina and jeopardize the neurological integrity of spinal nerve roots throughout the spinal column. This assault on neurological integrity leads to localized excitement of efferent neural pools, causing abnormal motor responses in vasomotor, visceromotor and somatomotor activity i.e dysafferentation.[5,44]

The above deals with the well-perceived "nerve irritation" and/or the "synaptic" model of subluxation. Recently, however, the "Tonal" model with its resonance centers and non-synaptic message transmission has been able to further our understanding of not only message propagation, but also of the Mental impulse.[44,45] Digressing from the widely applied linear view of neural involvement, Sturm recently proposed a chaotic construct of neuronal synchronization on a cellular level, further adding increased awareness of the number of models which tackle the understanding of the principles on which chiropractic is based.[46]

As there are a small number of varied views on what constitutes chiropractic care and in order that there may be uniformity of comprehension, we thought to take a moment and list the commonly accepted components of a vertebral subluxation as defined within the context of this study. The latest, and most clinically astute definition is that the vertebral subluxation is made up of three entities or components:

1. Dyskinesia
2. Dysponesis
3. Dysautonomia[44]

Aberrant neurogenic responses promoted by the vertebral subluxation, and/or pelvic distortion, can have far-reaching effects on development. In children, for example, such responses can not only affect vascular beds and vascular supply of growing epiphysis, but also change muscular tone leading to muscular and osseous asymmetry thereby altering normal osseous development. To further clarify this point, one must recognize that in any scoliotic curvature, more stress is placed on vertebral end plates and discal matter at the concave aspect of a curve. Unilateral stresses such as these cause alterations and remodelling within the architecture of young growing bone and disc material. Such stresses hasten an earlier onset of osteoarthritic degeneration.[5,47]

Stresses of spinal curvatures and aberrant spinal function propagated by the PDSC, produce adaptive vertebral subluxations in areas of maximal strain. These subluxation complexes alter normal neural homoeostatic reflex activity predisposing the individual to facilitated and abnormal somatovisceral and/or somato-somatic efferents with a possible viscero-somatic return.[48] Thus, the seeds of vertebrogenic disease are planted. Embarrassment to the autonomic nervous system has been noted by many as the medium between scoliotic biomechanical distortions and visceral histopathophysiology.[3,5,6-11,13,14,21,47-51] Yamada observed that this can be readily seen as sympathetic involvement affected through irritation of the dura as mediated by the PDSC.[52]

It is interesting to note that of the 677 children examined, 650 demonstrated the presence of the Pelvic Distortion Subluxation Complex. That finding translates into 96% of children in our study being affected by PDSC. We feel that children who comprised our study were average kids one would find living next door, or in a school yard, or a basketball game. To extrapo-

late this figure into the general population would mean that the vast majority of children in the developmental stages of their lives are afflicted with this entity. That fact alone would probably explain the general state of "unwellness" manifested by children in general, if one adheres to the pelvic stability-neurohomeostatic theory.

In the most simple of criteria, we determined a child to possess PDSC if there was a malfunction of either of the sacroiliac articulations - either hypo or hypermobility of the superior aspect of the articulation. It was interesting to note that while 96% of the original 677 sample of children demonstrated the presence of PDSC, the preponderance was noted as a fixation of the left SI articulation. At present, we have no explanation for this phenomena.

A fixation of one side of the pelvic mechanism results in an adaptational contralateral hypermobility of the opposing aspect in the majority of children. At the onset of this study, our assumption was to expect an approximate 50/50 distribution pattern with respect to fixation of the left versus the right SI articulation. Although there have been a small number of children who have demonstrated a fixation of the right articulation and a corresponding hypermobility of the left, or a fixation of both, the preponderance was a left fixation at the superior joint and a corresponding hypermobility of the right.

**Results**

Table 1 and related charts show the relative incidence of fixation in the three groups of children examined.

The charts are expressed as percentages of the total number of children in each age group.

The distribution of left fixation of the pelvic apparatus is fairly consistent across all age groups and sexes. The same can be said for the other parameters, i.e. right and bilateral fixations.

It is interesting to note that we found the PDSC does not favour any sex or age - both are affected. As you will see further in our paper, the PDSC with its left side predilection for fixation, can readily correlate with certain spinal configurations. For example, the majority of children who present with PDSC as a left fixation, also exhibit a scoliotic left - C Curve.

Taking into account that the PDSC appears to affect all age groups and sexes within the parameters mentioned, Table 2 and its corresponding chart demonstrate the total percentages of children affected across all age groups for our entire study sample of 650 children.

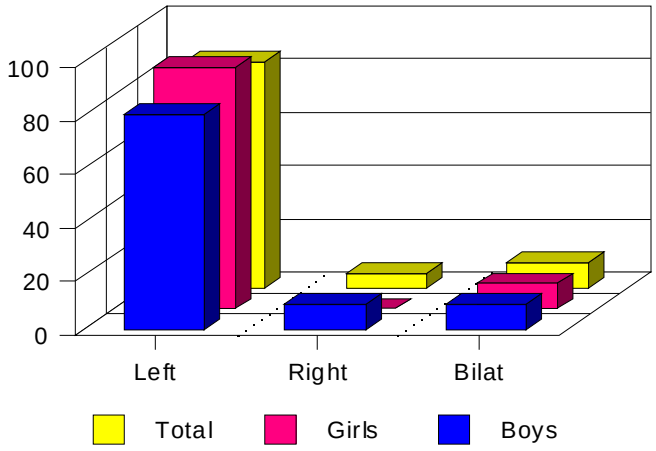
One can readily notice that the preponderance of PDSC is to present with a left pelvic fixation and a corresponding right hypermobility. Keeping in mind that the PDSC is an umbrella name given to a functional pelvic distortion regardless of side of presentation, we have found that in summary, when all the percentages are taken into account, 96% of all children in our study seem to possess, and be subjected to, the effects of the Pelvic Distortion Subluxation Complex.

If our sample of children is fairly representative of the health expression of most children in any given community then the vast majority of children experience the adaptational effects of the PDSC.

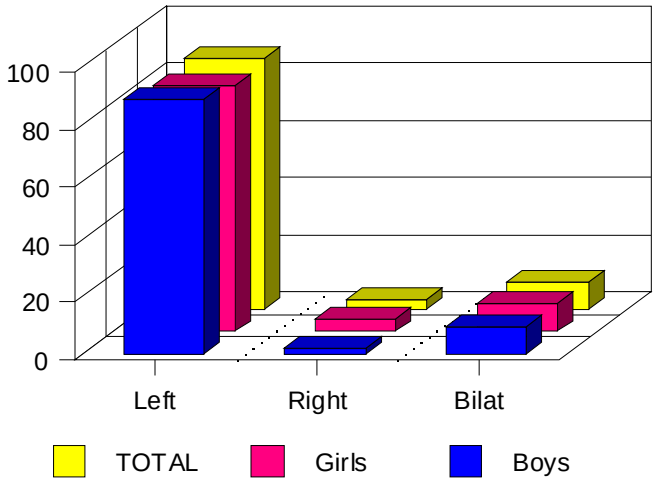
**Table 1**

| | 2 - 4 age group | | | 5 - 12 age group | | | 12 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|---|
| Fixation | Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| Left | 80.5 | 90.6 | 84.9 | 88.6 | 85.9 | 87.2 | 89.7 | 87.1 | 88.3 |
| Right | 9.7 | — | 5.5 | 2.0 | 4.4 | 3.2 | 3.9 | 9.4 | 6.8 |
| Bilat | 9.7 | 9.4 | 9.6 | 9.4 | 9.7 | 9.6 | 6.4 | 3.5 | 4.9 |

**Incidence of Fixation in 2-4 year group**




**Incidence of Fixation in 5-12 year group**




**Incidence of Fixation on 13-18 year group**

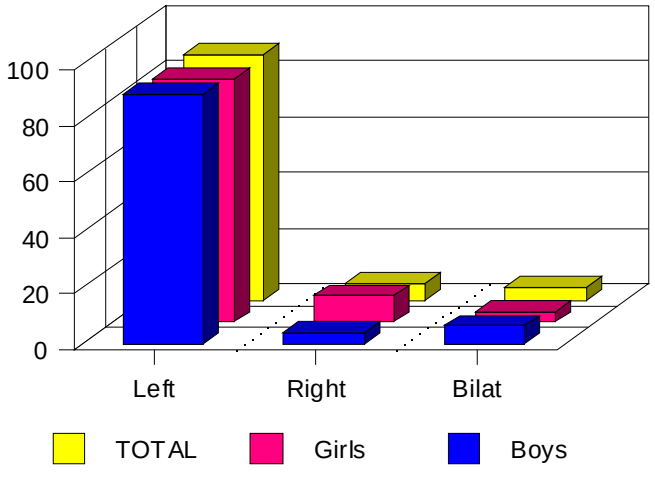
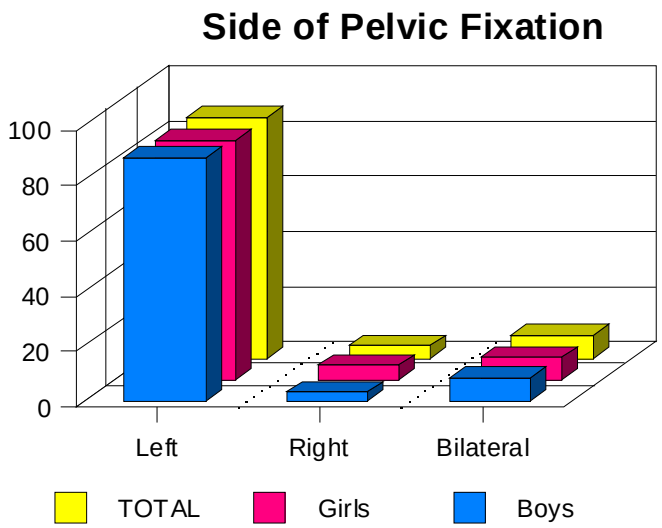


**Table 2**

| Side of Fixation | BOYS | GIRLS | TOTAL SCORES |
|---|---|---|---|
| LEFT | 87.9 | 86.7 | 87.3 |
| RIGHT | 3.4 | 5.3 | 4.3 |
| BILATERAL | 8.7 | 8.0 | 8.4 |




### Kinetic Chain Effects

The PDSC, as commonly observed, is a factor in many reflex automatic adaptive mechanisms. One of these, we observed, is a hypertonicity of the Tensor Fascia Lata on the hypermobile side of the pelvis as well as a corresponding involvement of the Piriformis. These produce a compensatory rotation of the Femur, the Tibia, and alter the juxtaposition, as well as the dynamics, of the Tibio-Fibular articulation. This cascade of effects alters the functional mechanics of the Tibia, the Fibula, the Femur, as well as the Patella and the supporting ligamentous and muscular apparatus. The resultant kinesiopathology produces reflex hypertonicity of the muscles of the Anterior Compartment on the ipsilateral side causing a dysfunction of the ankle mortis and knee mechanism. This in turn produces stress on the Deltoid ligamentous supporting structures, thereby affecting the stability of gait mechanics.

We have observed that these are the children who complain of knee pain - even as adults. The knee pain seems to be localized to the right knee in most cases, and seems to be localized on the side of pelvic hypermobility. These are the patients who seem to have on-going knee problems which then need therapy and even surgical intervention.

### Concomitant Health Complaints

Children in our sample had certain initial intake complaints which seem to be universal and affect many children. We feel that these complaints are the result of neuro-adaptive responses which have been propagated, fully or partially, by their PDSC. These complaints would, under ordinary circumstances, be relegated to the care of the family physician. However, as a result of parental choices, these parents sought chiropractic care for their children instead. We arranged these most commonly seen complaints into five primary groups:

1. Somatic
2. Visceral/Autonomic
3. Behavioural
4. Immune
5. Other

These complaints were either voiced by the child or their parents. It is important to note that in many instances, a child was found to have more that one complaint and that the diagnosis was made by a prior health practitioner. All children who had complaints in any category however, had one common denominator - the Pelvic Distortion Subluxation Complex.

### Somatic Complaints

These were further broken down into boys and girls, three age classifications, and seven sub-groups of complaints:

1. *Leg /Arm Pain/Numbness* See Table 3 and related chart.

These would include diffuse leg cramps, leg pains, upper limb pains and feelings of numbness. Looking across all age groups, we found that 23.2% of girls exhibited these symptoms as compared to 19.6% of boys. In total, 21.4 % of all children experienced this complaint.

2. *Low Back Pain/Sciatica/Scoliosis* See Table 4 and related chart.

This complaint consisted of any leg pains, back discomfort, and spinal curvatures noticed by either parents or the child. Scanning all age groups, we found that 14.2% of boys experienced these complaints as compared to 19.2% of girls. In total, 16.6% of children experienced these symptoms

Again, please note that as chronological age increases, so does overt symptomatology. We noticed that even in children as young as two years, there are early beginnings of future difficulties. It is also interesting to note that in girls of the 13-18 age group, almost 50% have these problems as compared to only 32% of boys. As stated before, we feel that these are the results of a chronic adaptive pattern to a PDSC.

**Table 3**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | T OTAL |
| 7.7 | 5.9 | 6.8 | 15.0 | 13.2 | 14.1 | 37.0 | 54.8 | 46.1 |

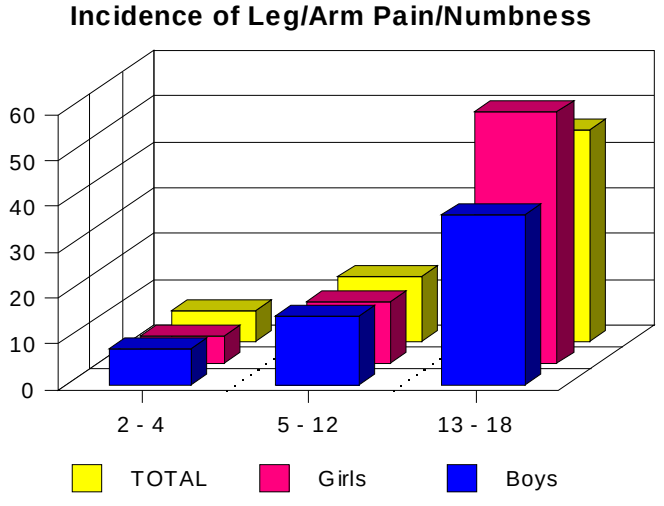
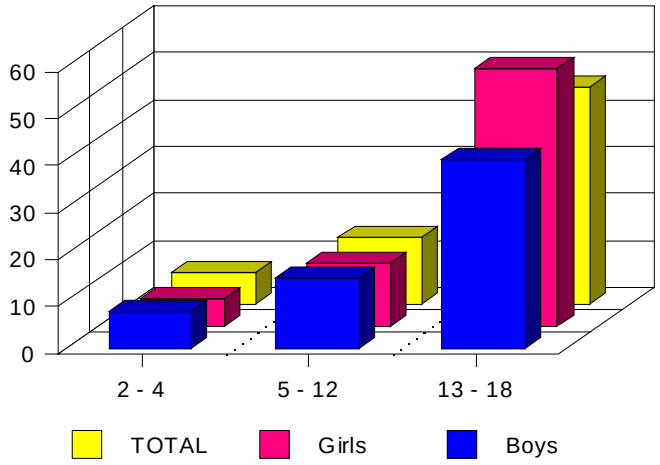


**Table 4**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 2.6 | — | 1.6 | 9.2 | 10.2 | 9.7 | 32.1 | 48.8 | 40.6 |

**Low Back Pain/Sciatica**




*3. Neck Pain*

This category included pain, discomfort, stiffness, reduced range of motion, etc. 14.4% of boys were affected as compared to 13.0% of girls. In total, 13.7% of all children in our sample complained of these symptoms. See Table 5 and related chart.

Again we noticed that as children become older, there are more incidents of neck pain and related complaints. As mentioned above, these are the results of adaptive patterning to a chronic PDSC.

*4. "Growing Pains"*

These include the so called "Restless Leg Syndrome" symptoms, including deep leg and knee "achiness" to the point where a child often cries himself/herself to sleep. 30.0% of boys were affected followed by 26.6% of girls. In total, 26.1% of children complained of these symptoms. See Table 6 and related chart.

Although many people seem to down play "growing pains" as something that a child experiences as a normal part of the growing up process, nevertheless, the trend is unmistakable - more girls are affected than boys in the Toddler years. In the pre-teen group, boys seem to be affected more than girls and the incidence of boys affected increases almost five fold as compared to the 2-4 age group. In total, 28.3% of children in our sample complained of this problem. We hypothesize that this complaint is the direct result of adaptation to PDSC.

"Growing Pains" have always been explained away as a normal part of childhood. Parents have been told that ligaments are stretching, bones are growing, etc. It is seen as normal that they should somehow "hurt". To the average parent, this explanation seems very plausible. If that were the case however, why is it that only the legs hurt? The other body parts don't grow? Why don't they produce pain?

**Table 5**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | 13.0 | 9.8 | 11.4 | 24.7 | 26.2 | 25.5 |

**Incidence of Neck Pain**

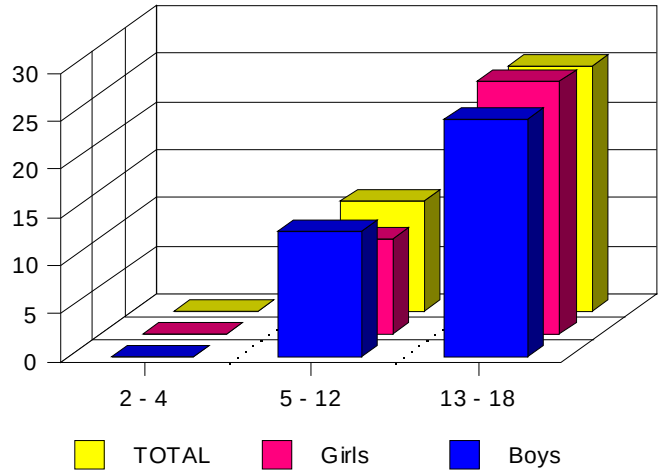
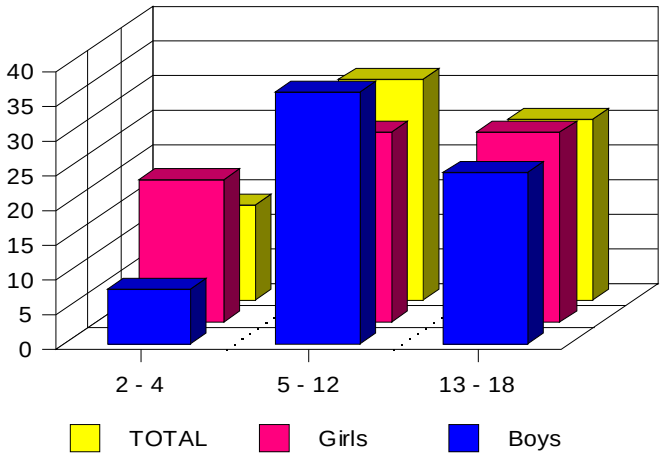



**Table 6**

| 2 - 4 age group | | | 5 - 12 age group | | | 3 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girl | TOTAL |
| 7.7 | 20.6 | 13.7 | 36.2 | 27.3 | 31.8 | 24.7 | 27.4 | 26.1 |

**Incidence of Growing Pains**




*5. Sinus problems*

These difficulties involved chronic post nasal drip, sinusitis and sniffling. 4.0% of boys and 5.3% of girls were affected. See Table 7 and related chart.

A total of 4.6% children complained of these symptoms.

Again it is apparent, that as children become older, we see an increased incidence of these problems. In the 5-12 age group, twice as many girls are affected as boys. This finding seems to become fairly equal in the early teen years, as boys apparently catch up to girls.

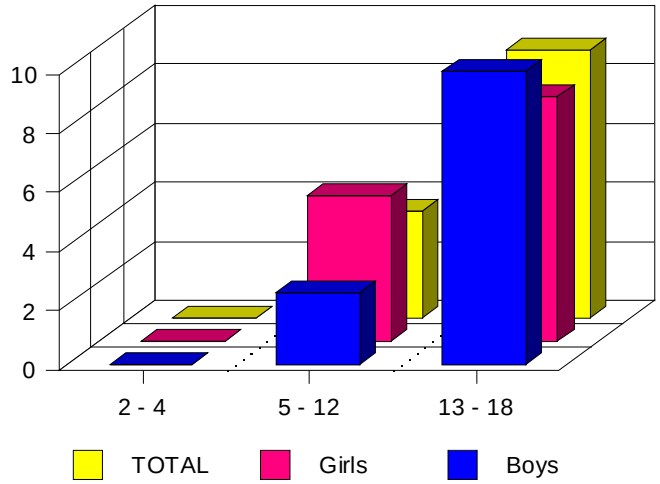
*6. Headaches*

This group of complaints includes all types of head pains, pressure, and discomfort - either frontal or occipital. 33.0% of boys experienced this complaint as compared to 42.4% of girls. In total, 37.7% of children complained of this problem. See Table 8 and related chart.

**Table 7**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | 2.4 | 4.9 | 3.6 | *9.9* | *8.3* | *9.1* |

**Incidence of Sinus Problems**




Again, as children age, the incidence of headaches seems to increase - of all the somatic complaints, Headaches are the most prevalent. It is interesting to note that girls are more affected across all age groups.

*7. Dizziness*

This complaint encompassed lightheadedness, vertigo, and fainting. 4.0% of boys experienced this problem as compared to 6.8% of girls across all samples with a total 5.4% incidence for all children. See Table 9 and related chart.

As noted previously, symptomatology seems to show an increase with the age of the child. Again, girls exhibited a considerably greater prevalence of incidence than boys.

**Table 8**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 2.6 | 11.8 | 6.8 | 34.3 | 40.0 | 37.1 | 44.4 | 60.7 | 52.7 |

**Incidence of Headaches**

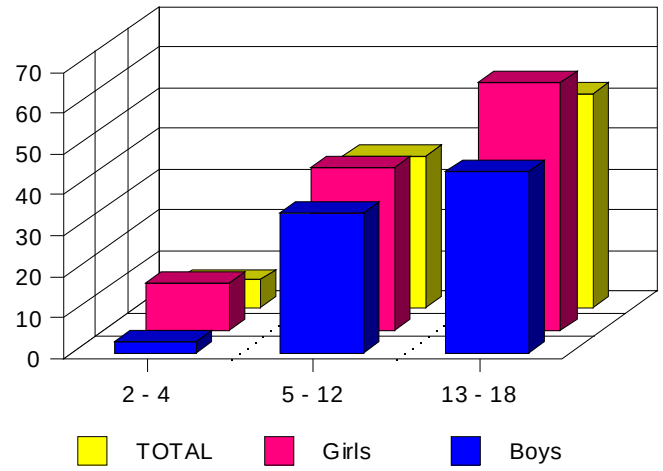
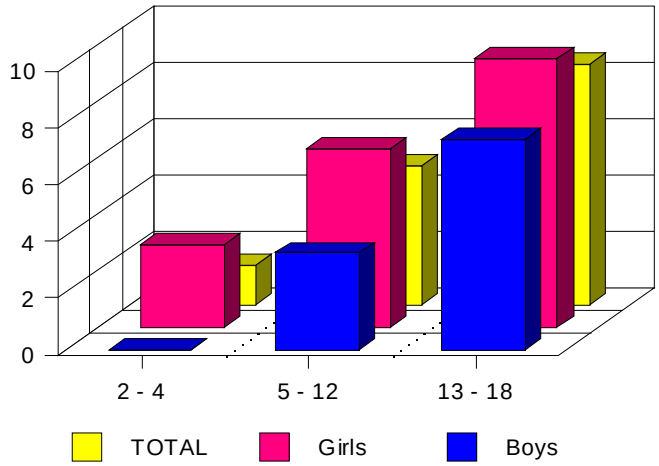



**Table 9**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | 2.9 | 1.4 | 3.4 | 6.3 | 4.9 | 7.4 | 9.5 | 8.5 |

**Incidence of Dizziness**




**Visceral / Autonomic Complaints**

These were further dissected into eight sub-classifications of complaints, three age groups, as well as sex.

*1. Stomach problems / indigestion*

These symptoms involved the commonly seen stomach "achiness," cramping, "tummy upsets", and other symptoms of an indescribable nature. In general, 17.7% of boys experienced these complaints as compared to 24.1% of girls. In total, 20.9% of children were affected. See Table 10 and related chart.

Once again, one can see an increase in incidence as children age. Again, the incidence appears greater in girls than boys and again there are deeply ingrained adaptive mechanisms which are becoming established patterns into adulthood at play.

*2. Bed-wetting / Bladder Dysfunction*

This category included frank wetting of the bed at night (nocturnal enuresis), dribbling, and loss of bladder control, even during the day. Our sample did not include children who were not toilet trained. See Table 11 and related chart.

17.1% of all boys across all age groups were affected, as compared to 9.3% of girls. The total number of children affected in our study sample was 13.2%.

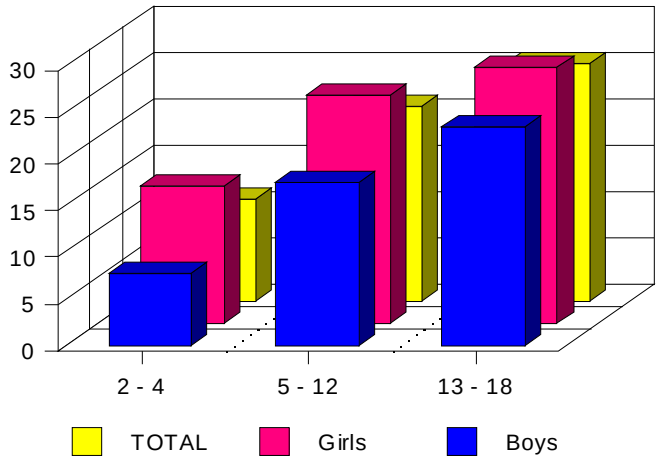
It is interesting to note that dysfunctions of the bladder are fairly evenly distributed between boys and girls in the 2-4 age group. In the 5-12 age group, more than twice as many boys as girls have bladder difficulties. It should be noted that this trend once again returns to equal sex distribution in the 13-18 age group.

One must realize however that bed-wetting is not a "boy thing" - girls are also affected. PDSC affects the neural components of the proprioceptive network as well as autonomic function vis a vis somato-visceral reflex loops. There seems more stress placed on the articulating pelvic structures in boys. This can be noticed as increased and more pronounced ridges and

**Table 10**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 7.7 | 14.7 | 11.0 | 17.4 | 24.4 | 20.9 | 23.5 | 27.4 | 25.5 |

**Incidence of Stomach Problems**




irregularities in the surface of the sacroiliac articulations. As well, male centre of gravity is more ventral to the SI articulations and predisposes these to more load and torque bearing.[26,27,28,34] Although this explanation is at best a hypothesis, we have noted the above relationships over the course of dealing with thousands of children.

There have been a number of studies which have demonstrated the effectiveness of chiropractic care in the resolution of nocturnal enuresis. Borregard especially noted that the correction of pelvic imbalance brought about very positive results.[53,57]

*3. Constipation / Diarrhea*

11.3 % of all boys seem to be affected as compared to 14.6% of girls. In total, 12.9% of all children in our study complained of these difficulties. See Table 12 and related chart. for the percentages of occurrence in each age group.

**Table 11**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 7.7 | 8.8 | 8.2 | 24.2 | 11.7 | 18.0 | 3.7 | 3.6 | 3.6 |

**Incidence of Bed Wetting**

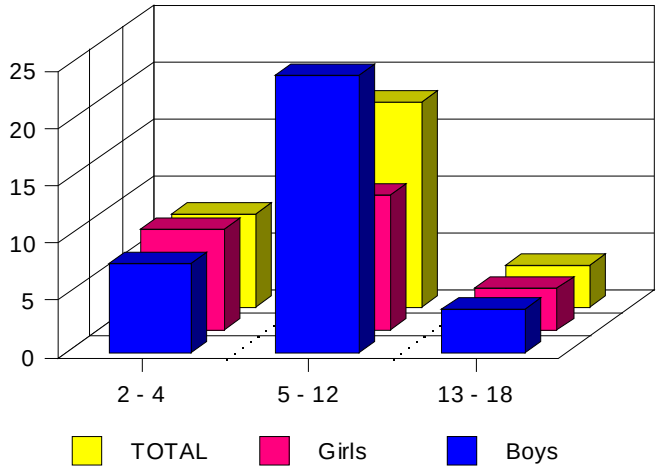
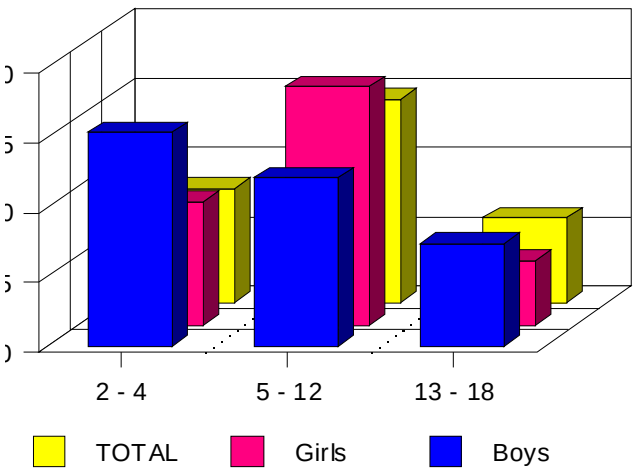



**Table 12**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 15.4 | 23.5 | 19.2 | 12.1 | 17.1 | 14.6 | 7.4 | 4.8 | 6.1 |

**Incidence of Constipation / Diarrhea**




As one can see from the trends, the largest percentage on incidence seems to occur in the Toddler years - and predominantly in girls, almost twice as much as boys. It is interesting to note that once children reach puberty, the incidence is fairly equal among both sexes.

*4. Asthma / Lungs / Breathing*

The incidence of girls and boys affected across all age groups appears to be 17.6% and 17.7% respectively. In total, 17.7% of all children in our 650 sample were experiencing difficulty with this problem. This translates into nearly one out every five children being affected by problems with catching their breath - Asthma. We have summarized the age and incidence percentage in Table 13 and related chart.

As one can see, the percentage of children with Asthma seems to be fairly consistent in all age groups with perhaps some increase in boys Vs. girls in the teen group. There, boys seem to have more incidence than girls whereas the incidence of Asthma in girls tends to decrease slightly with age. Although many studies have shown extremely positive results with Asthma when chiropractic care was introduced, nevertheless it represents a serious problem.[58-64] Again, we feel that this complaint is either fully or partially an adaptation entity to a PDSC.[7]

A number of researchers, however, have blamed this condition on environmental factors[65-69] and a quite a few on vaccination programs.[70,71] Of those, Classen and Diodati have been the most vociferous.[72,73]

*5. Fatigue*

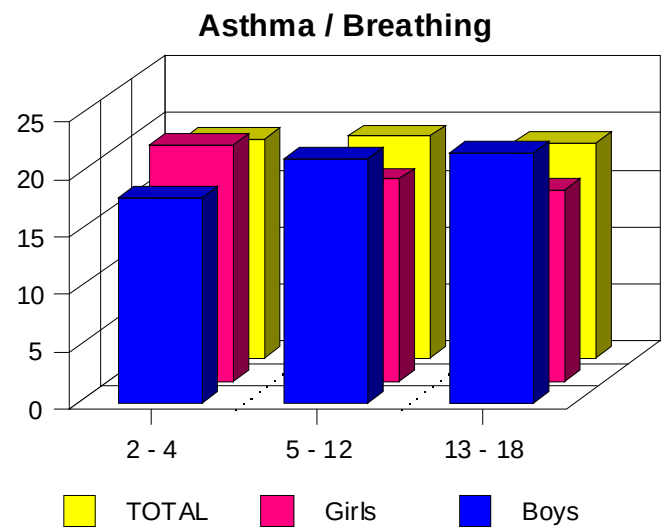
This category refers to non-specific fatigue - not related to a specific condition or disease process. These children ( or their parents) have complained of being “always tired.”

Examining all children across all age groups, 6.1% of boys and 7.4% of girls mentioned this problem. In all, 6.8% of children in our sample complained of fatigue. See Table 14 and related chart.

2-4 year olds did not complain of fatigue. The complaint begins in the pre-teen group, and in boys more than girls. In the

**Table 13**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 18.0 | 20.6 | 19.2 | 21.3 | 17.6 | 19.4 | 21.0 | 16.7 | 18.8 |




teen years, almost twice as many girls complain of fatigue as boys. We feel that it could be caused by hormonal factors and/or energy expenditure of the nervous system attempting to effect adaptation to a posturally inefficient internal environment - the PDSC. Much more study needs to be done before a conclusive statement can be made.

*6. Colic / "Stomach pains" / "Stomach cramps"*

This section deals with Colic (not infantile, because of the age of the children) as well as diffuse abdominal aches and pains which sometimes plague children. These complaints were not as a result of a specific disease process. 11.0% of all boys complained of this problem as compared to 11.1% of all girls. In total, 11.1% of all children in our study suffered with this complaint. See Table 15 and related chart.

**Table 14**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | 4.8 | 2.9 | 3.9 | 12.3 | 21.4 | 17.0 |

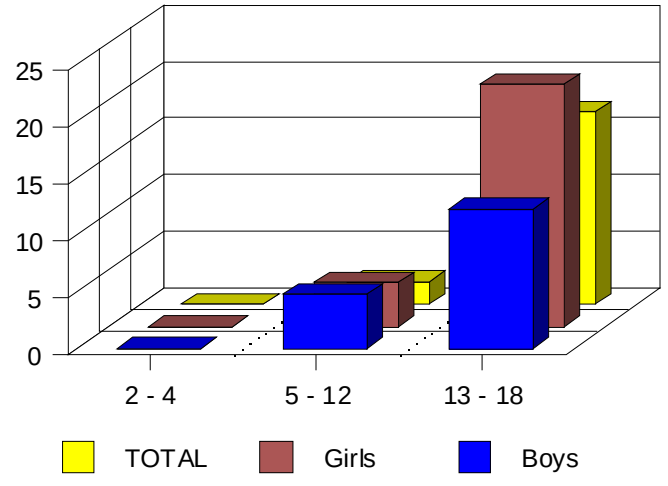
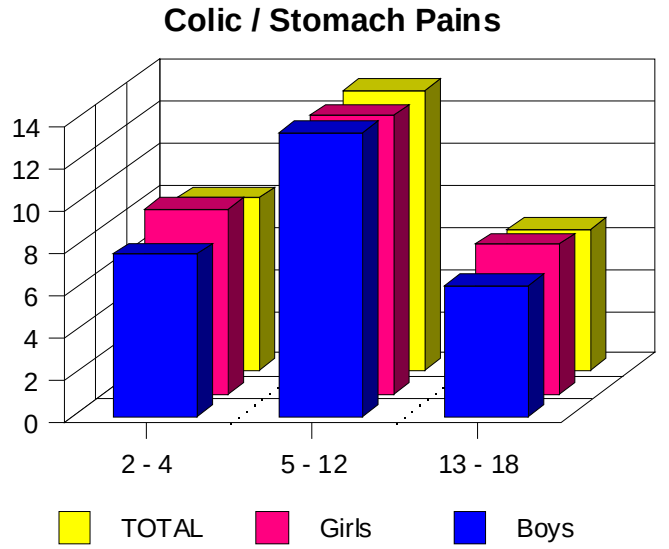



**Table 15**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 7.7 | 8.8 | 8.2 | 13.5 | 13.2 | 13.3 | 6.2 | 7.1 | 6.7 |




The incidence of colic and stomach pains seems to be evenly distributed among the sexes in all age groups although there seems to be an increased incidence in the pre-teen group. Again, these effects could be directly caused by, or contributed to, by Pelvic Distortion and its effects on visceral neural pools.[3,5,6,45]

*7. Croup*

2.4% of all boys were affected as compared to 1.2% of all girls. In total, 1.8% of children in our sample complained of this problem. See Table 16 and related chart.

We have noticed that almost twice as many boys as girls are affected with croup in the 2-4 age group. In the older age groups, the incidence of Croup is minimal across both sexes and tends to be nil in girls in the teen years whereas the incidence of Croup tends to increase in boys in the teen group.

*8. Menstrual Cramps / Dysmenorrhea*

This was a complaint of 2.4% of the female members of the 13-18 age group only. See Table 17 and related chart.

Only girls in the 13-18 age group mentioned this complaint. We found that fact surprising as menstrual difficulties have been noted by many practitioners in the early teenage years. As well, the small number of girls presenting with this complaint was also surprising. We thought that this low percentage may be caused by the embarrassing nature of this problem. The effects of Chiropractic care as applied to girls with dysmenorrhea were encouraging.[74,75]

**Behavioural Complaints**

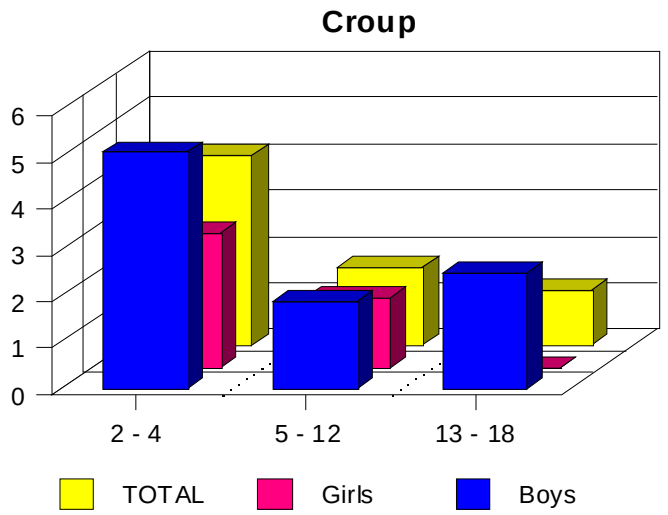
These also have been divided into sex, three age classifications and six sub-groups of complaints:

*1. Hyperactivity (ADHD)*

There are a number of studies showing a positive relationship between chiropractic care and Hyperactivity.[1] Hyperactivity is the name commonly given to Attention Deficit Hyperactivity Disorder (ADHD). In this section, we have attempted to

**Table 16**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 5.1 | 2.9 | 4.1 | 1.9 | 1.5 | 1.7 | 2.5 | — | 1.2 |




deal with ADHD and Attention Deficit Disorder (ADD) from the perspective of occurrence, sex predominance, and age of children affected. The percentages of occurrence in each age group are listed in Table 18 and related chart. It is interesting to note that 17.4% of all boys in our sample were labelled with this diagnosis as compared to 7.7% of girls. In all, 12.6% of children in our sample wore this label.

It is interesting to note that this seems to be a predominantly male condition. There are almost three times as many boys as girls with "hyperactivity" in the 5-12 age group. In the toddler group, the ratio of boys with hyperactivity to girls is approximately 1.5:1 and this doubles as boys reach their pre-teen years. That ratio seems to revert to the toddler class level in the early teens. It is interesting to note that the percentage of girls la-

**Table 17**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | — | — | — | — | 2.4 | 1.2 |

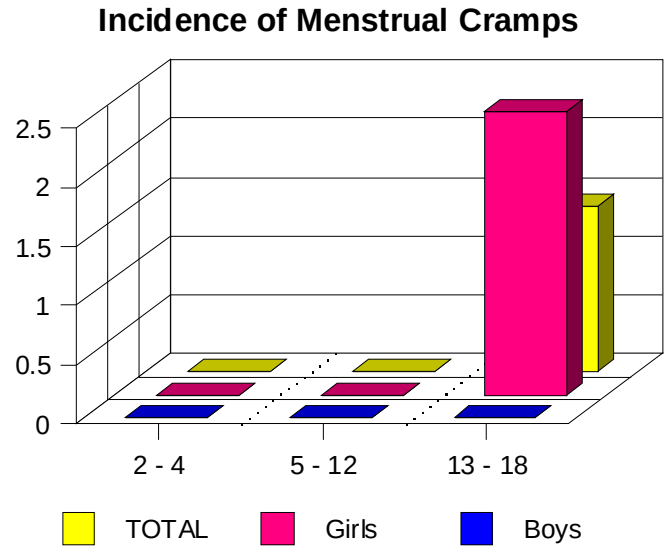
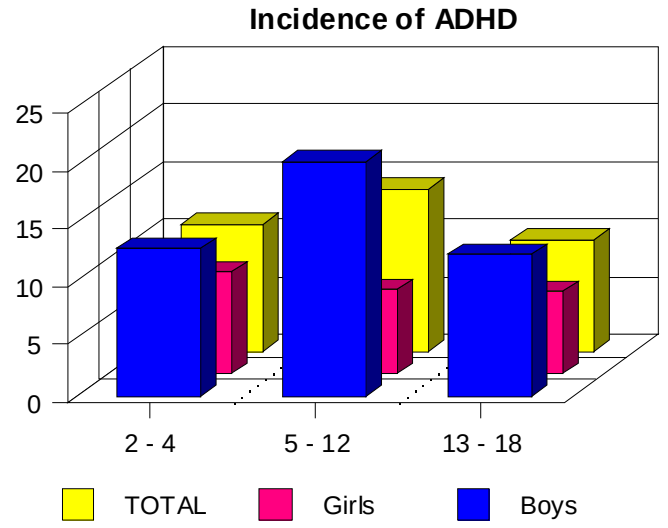



**Table 18**

| 2 - 4 age group | | | 5 - 12 age group | | | 13 - 18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 12.8 | 8.8 | 11.0 | 20.3 | 7.3 | 14.1 | 12.3 | 7.1 | 9.7 |




belled with this condition is fairly constant throughout the age groups.

It has been stated that ADHD can be traced to trauma of a difficult delivery with neurological sequella.[1] This changes a child's perception of reality and thus his/her behaviour is commensurate with that reality. This finding seems to support the hypothesis that ADHD is both a possible result of a traumatic delivery and/or behavioural and learned deportment.

If the incidence of occurrence of ADHD in girls can be taken as a baseline of the incidence of the stress of delivery producing the symptoms of ADHD, then the incidence appearing in boys less that in girls would lead to the learned and behavioural factor.

We must also add, that while this is not a political paper, a number of researchers feel the diagnosis of ADHD is in peril: There are no tests for this condition, many suspect that this diagnosis was invented and does not exist, and that the manufacturer of Ritalin is facing three separate law suits at the time of writing of this paper.[1,76,77]

*2. Learning Difficulties / Slow Academics*

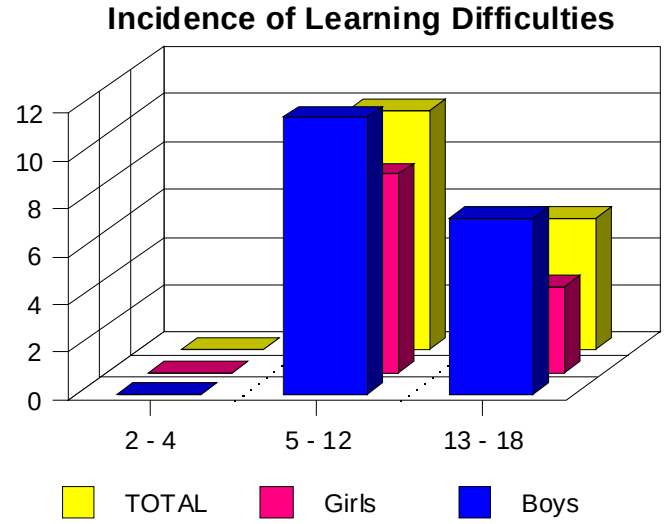
These are the children whose parents mention that they are having difficulty grasping concepts that are taught to their peer group. There is either a lack of focus or loss of concentration ability, as related by parents. 9.2% of all boys in our sample were affected by this difficulty as compared to 6.2% of girls. In all, 7.7% of children experienced this problem. See Table 19 and related chart.

It is interesting to note that none of the children in the Toddler group were affected with complaints of learning difficulties. Parents of boys in the 5-12 age group complained of these problems a bit more than girls in the same age group. 11.6% vs 8.3%. It is also interesting to note that in the teen group, twice as many boys as girls experienced this problem.

There are a number of musings which one hears in relation to this complaint; that it can be caused by trauma during birth, that it can be the result of vaccine damage, that it is genetic,

**Table 19**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | 11.6 | 8.3 | 10.0 | 7.4 | 3.6 | 5.5 |




nutritional, etc. Much more study needs to be done before a definitive statement can be made.

*3. Temper Tantrums*

No boys in our sample complained of this problem. In all, this accounted for 0.2% of children in our sample. See Table 20 and related chart.

At the risk of appearing sexist, it struck us as strange that Temper Tantrums should appear as a girl "thing" only, based on the statistics.

*4. Memory Problems:*

As in the category above, this complaint was primarily related to the girl population of our study. 0.3% of all girls seemed to be affected. In all, this represented 0.2% of the whole sample of children. I should add that only one child presented with this complaint. See Table 21 & Related chart.

Again, it is interesting to note that this complaint is mainly noted in girls. This was surprising as many people seem to feel that it is boys who have a difficulty with memory. We have not found that to be the case although only one child presented with this problem. To extrapolate into a population would not be wise.

*5. Sleeping Difficulties*

This complaint was related to waking up at night, not being able to fall asleep, or not being able to stay asleep. 11.3% of all boys were affected as compared to 7.1% of all girls. In all, 9.2% of all children mentioned this complaint. See Table 22 and related chart.

Sleeping difficulties seemed to be noted primarily in boys (10.3%) as compared to girls (2.9%) in the Toddler group. In total, 6.8% of children in this age group were affected. This complaint seemed to increase in occurrence (13.0%) in boys in the pre-teen group as compared to girls who only had a 4.9% occurrence. In that age group, 9.0% of children were affected with this difficulty. It is interesting to note that in the toddler group and the pre-teen group, boys are three times as affected as girls with difficulty sleeping. It is also interesting to notice that this ratio inverts drastically in the teen group.

There, girls (14.3%) are more affected than boys (7.4%). for a total of 10.9% of that age group. We feel that this inversion could be the result of neural adaptation to PDSC but also caused by social and hormonal pressures seen in teen girls.

*6. Crying Spells*

This complaint consisted of general crying and whining for no apparent reason and was not associated with any condition. 5.5% of all boys and 3.4% of all girls were blamed. In all, 4.5% of our sample experienced difficulty with this problem. See Table 23 and related chart.

**Table 20**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | 2.9 | 1.4 | — | — | — | — | — | — |

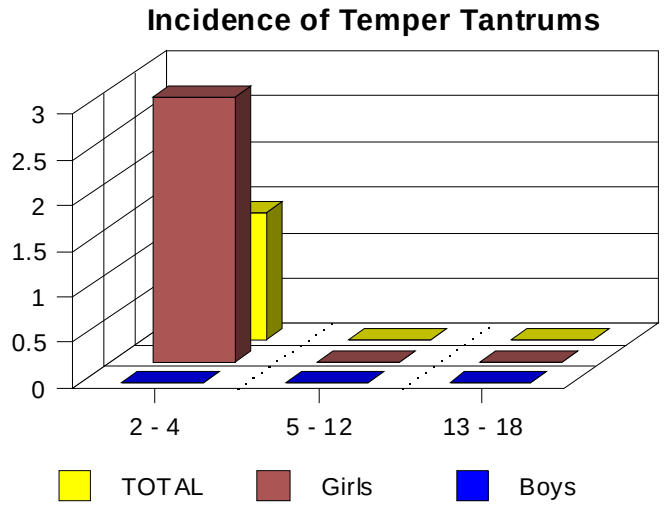



**Table 21**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | — | 0.5 | 0.2 | — | — | — |

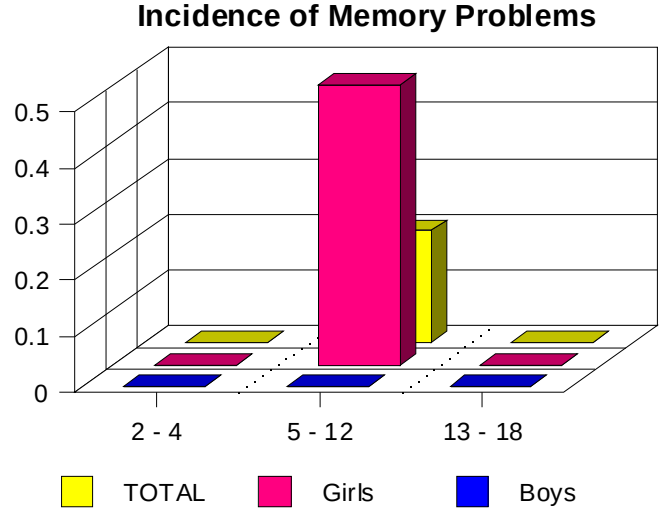
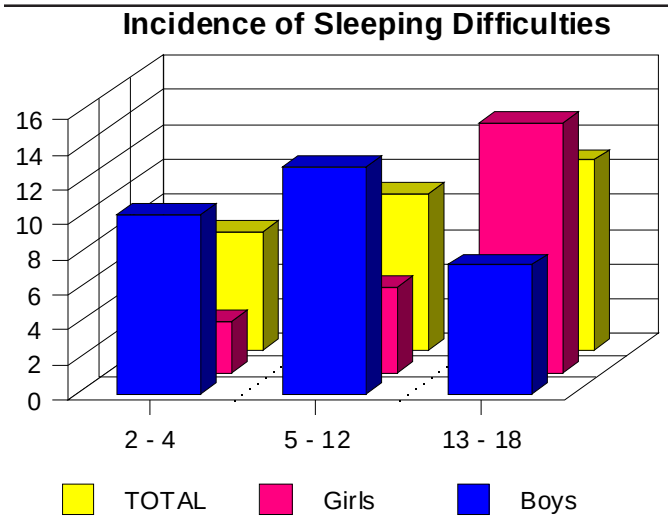


**Table 22**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 10.3 | 2.9 | 6.8 | 13.0 | 4.9 | 9.0 | 7.4 | 14.3 | 10.9 |




To no surprise, crying spells were more frequently noted in the Toddler group where the ratio of girls (11.8%) affected outnumbered boys (5.1%), 2:1. What was surprising to note is that the ratio of boys (7.2%) far outnumbered girls (2.4%) or a 3:1 ratio, in the pre-teen group. In the teen group, girls again outnumbered boys by 2:1, 2.4% vs 1.2%. Again, this effect could be the result of hormonal and social stresses of teen girls.

**Immune Complaints**

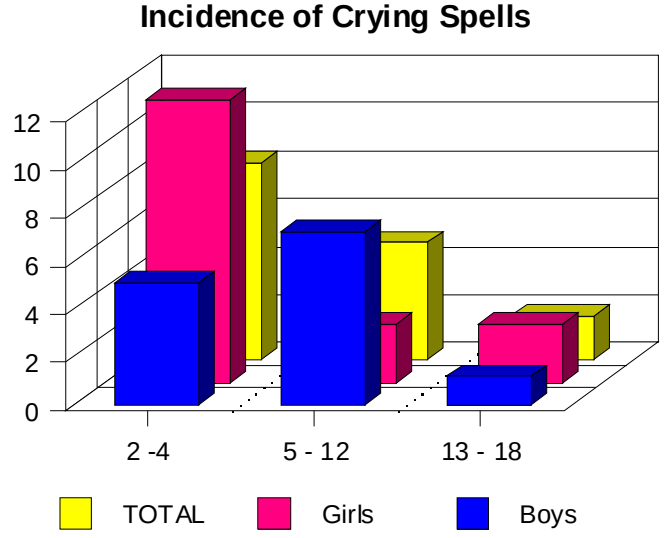
As in the other previously mentioned classifications, this section was investigated in light of the three age groups mentioned, sex distribution, and percentage of occurrence.

*1. Allergies*

Allergies in this section were not specific to "hayfever" only. Our context of allergies encompassed all hypersensitivities parents complained their children were plagued with.

**Table 23**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 5.1 | 11.8 | 8.2 | 7.2 | 2.4 | 4.9 | 1.2 | 2.4 | 1.8 |




We found an incidence of 27.8% among all boys and 22.9% among girls across all groups. In total, 25.4% of children of our sample were affected by allergies. See Table 24 and related chart.

It is interesting to observe that Allergies and Ear Infections represent the largest classification of health complaints affecting children - second only to "Growing Pains" at 26.1%.

As well, it is interesting to note that the incidence of Allergies shows an almost exponential rate of rise in boys throughout the age groups. By the time a boy-child has reached the teen years, the rate of occurrence is close to 40% - almost four times the occurrence seen in the 2-4 age group.

Girls are also affected but not to quite the same degree as boys.

It would be intriguing to do a follow-up study and measure the occurrence of allergies in the adult population and its possible relation to this rate of incidence.

Again, We feel that Allergies are a possible result of the neuro-immune effects of the PDSC, although some feel that they are caused by our vaccination program.[73]

*2. Colds*

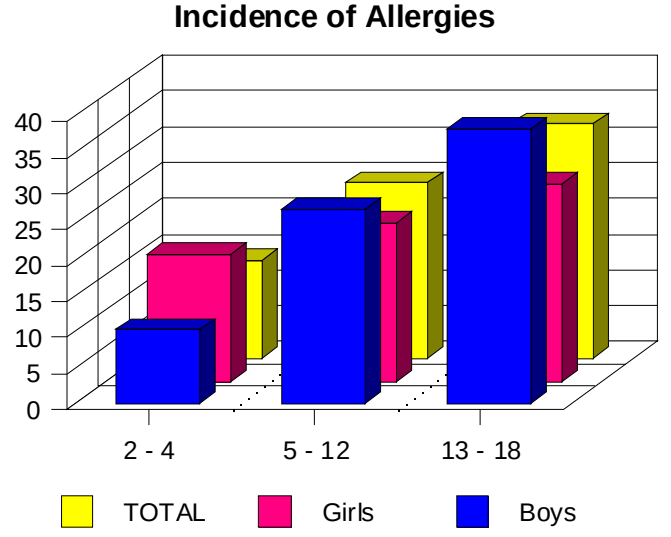
This section dealt with the frequency of colds, and rhinitis. See Table 25 and related chart.

It is interesting to note that almost 50% of girls in the 2-4 age group were affected with colds and the "sniffles". Boys were also affected but not to the same degree. As we scan the age groups, we see the incidence of colds decreasing, however, girls are slightly more affected than boys. Phillip Incao, a Colorado Ayurvedic physician, and Howard Weiner, a Harvard immunologist feel that colds, etc., are more prevalent in the toddler age group as they are needed to teach and exercise an immature immune system.[1,73,78,79] Other reasons could be the suppression of the immune system from vaccination according to the Jordan Report.[80]

We feel that it could also stem from the influence of PDSC on the developing neuro-immuno network. The response of

**Table 24**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 10.3 | 17.6 | 13.7 | 27.1 | 22.0 | 24.5 | 38.3 | 27.4 | 32.7 |



children with Upper Respiratory Tract Infections to chiropractic care has been very promising.[81]

*3. Ear Infections*

Ear Infections as well as Allergies are the second most common complaint that children have -"Growing Pains" are the first. 28.4% of all boys complained of this problem as compared to 22.3% of all girls. In all, 25.4% of all children were affected by ear infections - Otitis Media. This translates into one out every four children having ear infections as a Toddler. See Table 26 and related chart.

Ear Infections, which seem to be very prevalent in the Toddler group, tend to decrease in the older age groups, although children are still affected to a fairly high degree, even in the teen group. We tend to categorize the incidence of Ear Infections in a similar fashion to Colds - both deal with a maturing immune system. What is interesting is the incidence of ear infections we noted in the teen group - a time when the immune system would have matured. This led us to propose that there may be a factor in a child having Ear Infections which is not caused by an immature immune system. Taking into account our combined 40 year experience in pediatrics, we feel that Ear Infections are not an anatomically based problem - many EENT specialists tend to blame a horizontal ear canal in children as one of the causes of ear infections. If that line of thought was followed then the following results would not have been obtained;

Van Breda showed that only 31% of children under chiropractic care had episodes of Otitis Media as compared to 80% under standard medical care. Other researchers published similar findings. Still others feel that Otitis Media may also be caused by Immune system suppression and may be contributed to by our vaccination program.[81-90]

It is interesting to note that all children with Ear Infections also experienced the adaptational stresses of the PDSC.

*4. Fever*

This category refers to parents presenting a child to the office with fever.

**Table 25**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 33.3 | 47.1 | 39.7 | 17.9 | 21.5 | 19.7 | 7.4 | 9.5 | 8.5 |

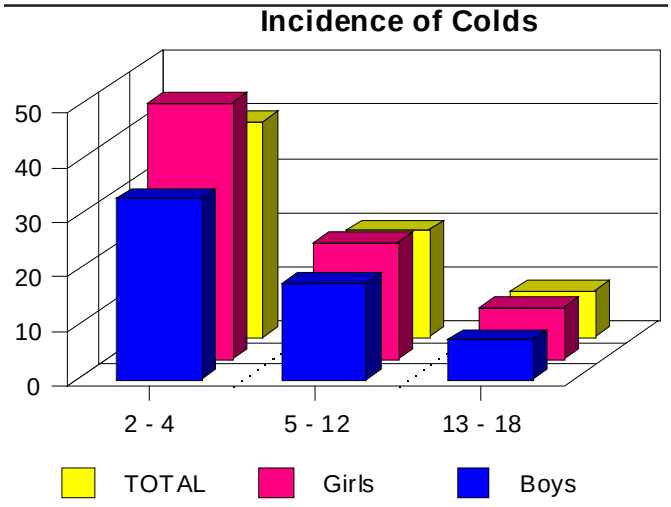
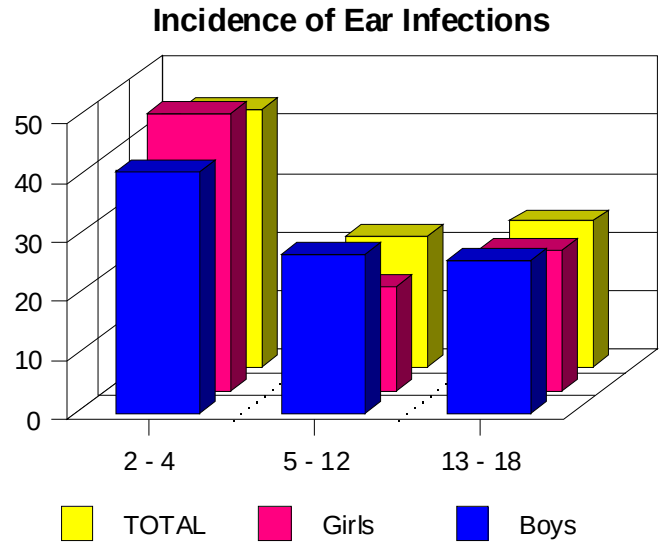



**Table 26**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 41.0 | 47.1 | 43.8 | 27.1 | 17.6 | 22.3 | 25.9 | 23.8 | 24.8 |




6.1% of all boys complained of this problem as compared to 2.5% of girls. In total, 4.3% of our sample of children presented with this complaint. See Table 27 and related chart.

The incidence of fever is almost the same in boys as girls in the Toddler group, whereas the 5-12 group exhibits a ratio of 3:1 incidence of fever in boys as compared to girls. This finding correlates well with the high incidence of Colds and Ear Infections in the Toddler group. Although still seen in the older groups of children, Fever in those ages does not constitute a large parental problem.

*5. Acne*

This was a complaint whose owners were girls in the teen years only. No other children presented with this difficulty. 0.6% of all girls presented with this complaint and this represents 0.3% of our sample of children. See Table 28 and related chart.

This was not a very common complaint, much to our surprise. 2.4% of the 13-18 age group girls presented with this complaint - 1.2% of the total children in the teen group.

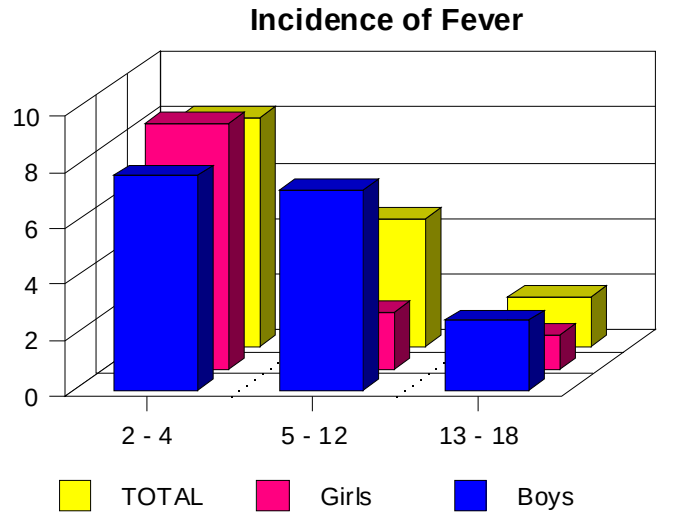
*6. Throat Complaints:*

This category dealt with sore throats, "Strep" throat, and Tonsilitis as presenting complaints. 0.3% of all boys complained of this problem as compared to 0.9% of all girls. In all, 0.6% of children in our sample mentioned this complaint. See Table 29 and related chart.

Sore throats, Tonsilitis, etc., seem to affect the Toddler group mainly, with girls being more involved than boys. Again, one of the reasons could be seen as an integral aspect of the normal maturation of the immune system. The other reason could be the neuro-imuno effects of Traumatic Birth Syndrome, the effects of traumatically induced vertebral subluxations, being raised under a different health paradigm, and the adaptational effects of PDSC.[88]

**Table 27**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 7.7 | 8.8 | 8.2 | 7.2 | 2.0 | 4.6 | 2.5 | 1.2 | 1.8 |




**Other Complaints**

We grouped these last two categories under the sub-classes of general check-ups, and Motor Vehicle Accidents/Trauma.

*1. Check-up*

These were children whose parents brought them to our Centre with no complaints - 11.9% of all boys fell into this category as compared to 11.8 girls. In all, 11.8% of all children came to our Centre with no complaints mentioned initially. See Table 30 and related chart.

The only significant datum gathered here is that over 10.0% of children are brought to a chiropractic office with no complaints - parents understand , accept, and agree with the role chiropractic plays in the health plan for their family. One must keep in mind that although these children presented with no complaints/symptoms, all had the presence of the PDSC.

**Table 28**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| — | — | — | — | — | — | — | 2.4% | 1.2% |

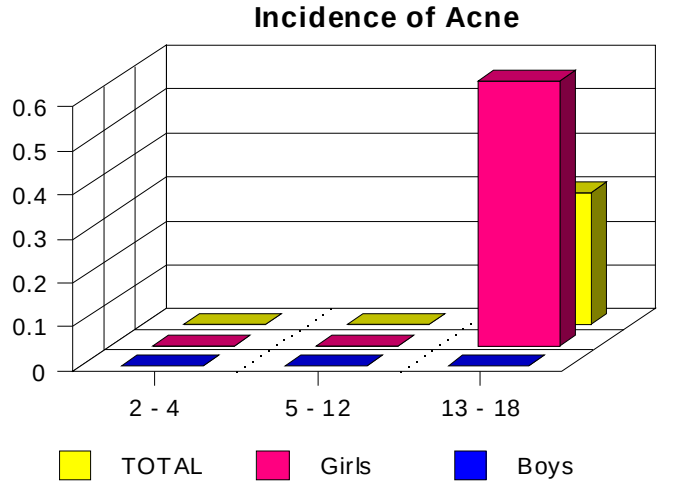
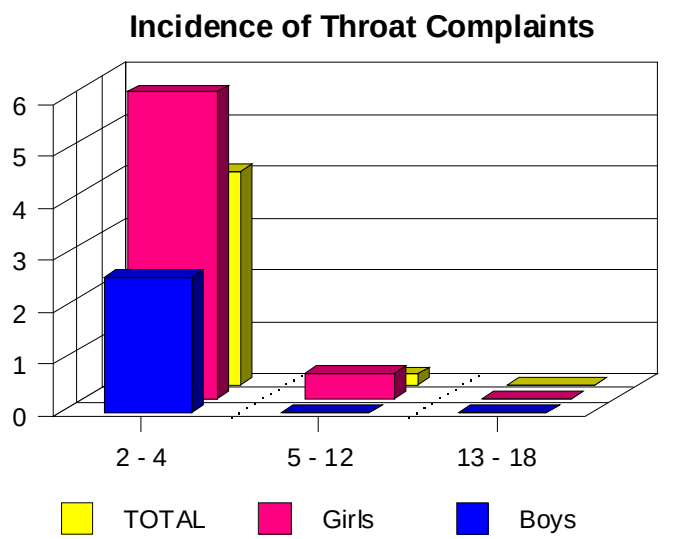



**Table 29**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 2.6 | 5.9 | 4.1 | — | 0.5 | 0.2 | — | — | — |




*2. MVA / Trauma*

These children were brought to the office as a result of a traumatic event - either a motor vehicle accident, or some other traumatic incident, which may or may not have necessitated some measure of emergency care. 1.5% of all boys and 0.3% of all girls mentioned this problem for a total of 0.9% of our sample. See Table 31 and related chart.

It seems that boys in the Toddler group were more prone to traumatic incidents. It could be the result of the nature of boys in general.

To give the reader some sense of rates of occurrence, we summarized the ten most common complaints into a percentage of the total children sample: See Table 32 and related chart.

The most common complaints listed above appear to be mainly of a somatic nature with some visceral and some im-

**Table 30**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 18.0 | 8.8 | 13.7 | 10.6 | 13.2 | 11.9 | 12.3 | 9.5 | 10.9 |

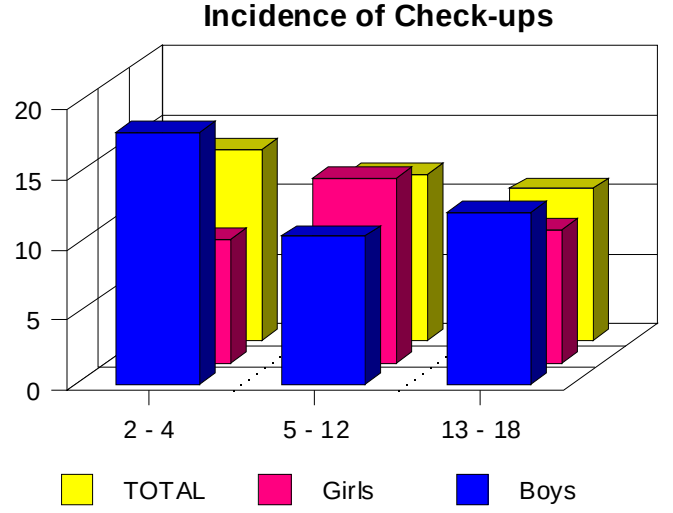
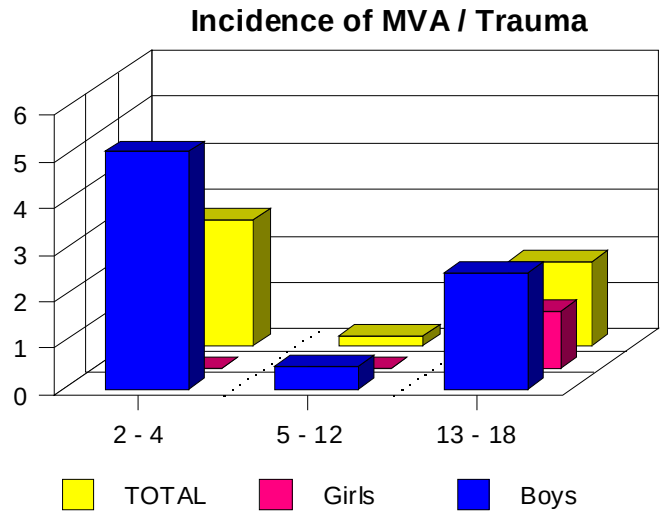


**Table 31**

| 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|
| Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| 5.1 | — | 2.7 | 0.5 | — | 0.2 | 2.5 | 1.2 | 1.8 |




mune components. We feel that these are good examples of the effects of PDSC on an average developing child.

As we have mentioned earlier, we feel that this represents a fairly balanced, average health picture of the average child in any community. What is of concern is that this level of health expression has been accepted as the normal operating state for a developing child.

As well as the five complaint groups we catalogued earlier, there have been two explicit observations we made that deserve distinct and very special consideration:

1. **Scoliosis**
2. **Spinal Degeneration**

Both are adaptive responses to a stressor and are generally not complaints children would make under normal circumstances.

**Scoliosis**

As is well known, there are essentially two types of Scoliosis - fixed and functional. The first is mostly the result of genetic alterations in the growth and development of the pelvis and/or spinal segments. The second is primarily a result of alterations of function and is by far the most common form.[91-93] The most familiar form of this type is commonly referred to as Adolescent Idiopathic Scoliosis. We have decided to deal with this last expression only.

There have been a number of studies attempting to explain the incidence of scoliosis. No one individual has provided the correct answer. The reason, we believe, is that scoliosis is a multi factorial entity - there are a multitude of factors which need to be contemplated and addressed. Veldhuizen thought that the causes are most likely neuromuscular. After studying the effects of the PDSC we agree with his conclusions.

He felt that scoliosis is an aberration caused by defective postural equilibrium. That proprioceptive input from ligamentous, articular, and muscular components of the neuromuscoloskeletal system are an integral part of the body's postural equilibrium.

The resultant disruption in the postural reflex system - somatosensory pattern dysfunction, is likely the cause, not the result, of spinal curvatures. As a result, scoliosis tends to develop in two stages:

A. A small curve develops from a defect in the function of the proprioceptive system.
B. This curve is then exacerbated by biomechanical factors.[94,96-99]

We have found a correlation between the PDSC and the development and patterning of scoliosis. It is for this reason that we feel strongly all children should be checked for the presence of PDSC. A scoliotic curve presents with a microscopic composition of the IVD which is different on the convex and concave aspect of the curve. There is a decrease in the sulfonated GAGs on the concave aspect of the curve with a decrease in the pro and active MMP-2 and MMP-9 on the convex side, with the greatest changes being seen in the apical disc material.[95] These findings concur with Bland and are consistent with the onset of degeneration.[1]

These changes can be seen early in life and alter the composition of muscle fibers on either side of the curve. As a matter of fact, Evans found a 26% incidence of neuroanatomical abnormality in children between four and twelve years old.[97-99] This makes for a strong case that the PDSC is a most intense factor in the formation of Scoliosis.

We classified scoliosis under four distinct types of curvatures seen:

Left C-Curve
Left S-Curve
Right C-Curve
Right S-Curve

We then further classified these curvatures by the three age groups and sexes:

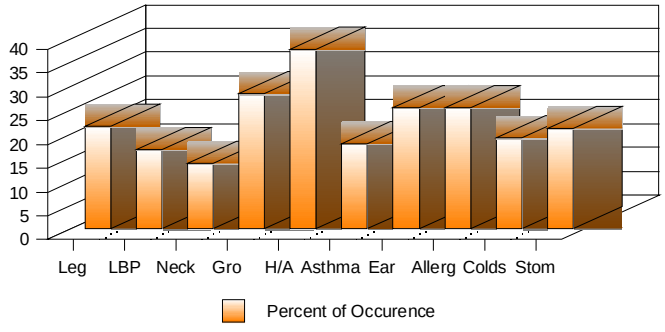
*1. 2-4 Age Group:*

Of our 2-4 age group sample, 23.8% of boys did not have any evidence of a spinal curvature of any sort - we would clas-

**Table 32**

| | |
|---|---|
| Leg / arm pain | 21.4 % |
| Low Back Pain | 16.6 |
| Neck Pain | 13.7 |
| Growing Pains | 28.3 |
| Headaches | 37.7 |
| Asthma | 17.7 |
| Ear Infections | 25.4 |
| Allergies | 25.4 |
| Colds | 19.1 |
| Stomach Problems | 20.9 |

**Incidence of The Ten Most Common Complaints**



sify this as “normal” although some have found that this is not the best or most suited adaptive spinal configuration to deal with gravity.[4]

Girls in this age group had a 16.7% incidence of normal. In boys, 62.5% of spinal curvatures were classified into a left or right configuration while 37.5% were not.

In girls, we were able to classify 90.0% of curvatures into left or right and 10.0% defied any classification.

The table below depicts the analysis of curvatures which were classified and assigns their respective percentages of occurrence: See Table 33 and related chart.

We have found that 80.0% of Boys had left curves as compared to 72.2% of Girls. As well, right curves were found more frequently in Girls (27.8%), as compared to Boys (20.0%). It was interesting to note that the most common spinal configuration for both sexes was the Left C-Curve - 70.0% in boys and 50.0% in girls with the right C-Curve being the second dominant feature in both sexes. In total, 57.1% of children displayed the L-C curve, 17.9% L-S curve, and 25.0% the R-C curve.

*2. 5-12 Age Group*

14.0% of Boys in this age group could be said to be normal with 86.0% displaying lateral curvatures of some sort. Girls were similar, 11.4% were normal and 88.6% showed lateral curvatures forming. Of boys with lateral curvatures, 28.6% were not classified while 71.4% were classified into either left or a right category. Girls displayed a similar picture: 24.4% were not classified, while 75.6% were. Table 34 depicts our analysis of classified curvatures in percentages of occurrence.

As in the 2-4 age group, the 5-12 age groups shows a similar incidence of distribution of curvatures. The L-C curve is predominant in both sexes in this age group, followed by the R-C curve. In total, 54.7% of children displayed the L-C curve, 16.2% had the L-S curve, 20.1% the R-C curve, and only 9.0% had the R-S curve.

**Table 33**

| | L-C | L-S | R-C | R-S |
|---|---|---|---|---|
| Boys | 70.0 | 10.0 | 20.0 | — |
| Girls | 50.0 | 22.2 | 27.8 | — |
| TOTAL | 57.1 | 17.9 | 25.0 | — |

**Types of Scoliosis (2-4 year olds)**

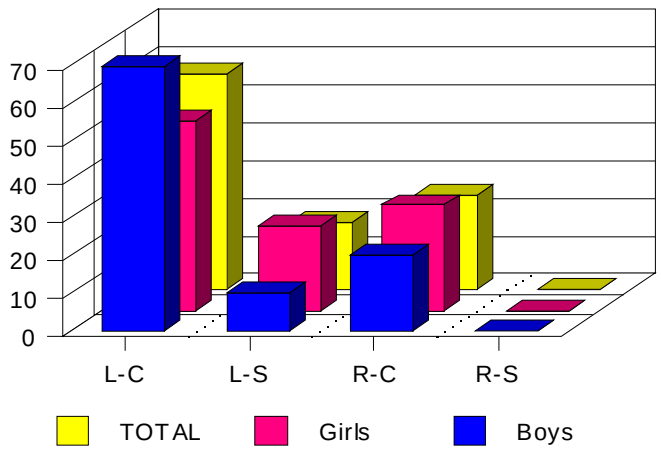
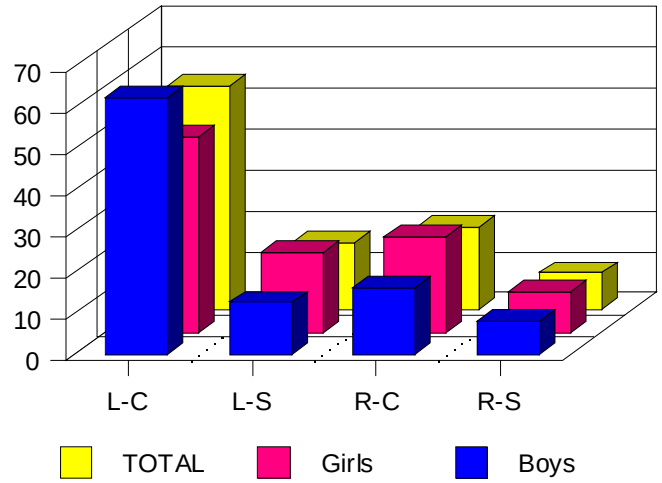



**Table 34**

| | L-C | L-S | R-C | R-S |
|---|---|---|---|---|
| Boys | 62.7 | 12.7 | 16.4 | 8.2 |
| Girls | 47.6 | 19.4 | 23.4 | 9.7 |
| TOTAL | 54.7 | 16.2 | 20.1 | 9.0 |

**Types of Scoliosis (5-12 age group)**




*3. 13-18 Age Group*

We found 15.6% of boys to be normal as compared to 21.2% of girls.

In boys, 29.2% of curvatures could not be classified as compared to 11.1% of girls which meant that we could classify 70.8% of boys’ curvatures and 88.9% of girls.

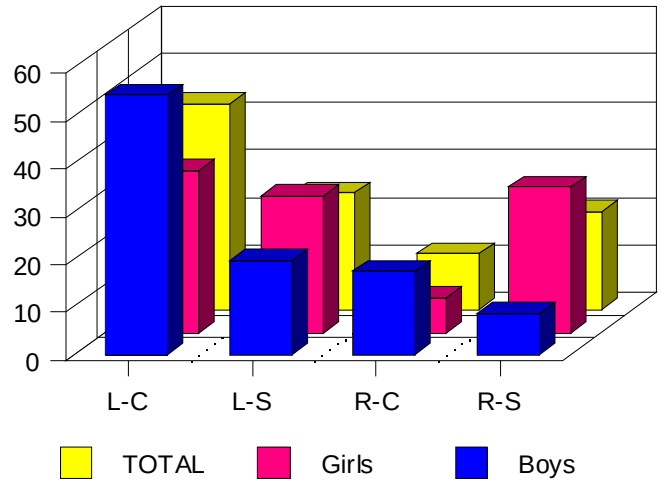
Table 35 shows our analysis of percentages of occurrence of classified curvatures

As in all the other groups, the left-C curve is most common, however it is beginning to lose its frequency. What is interesting to note is that the right-S curve, and to some degree the L-S curve, have increased in occurrence in the female population

**Table 35**

| | L-C | L-S | R-C | R-S |
|---|---|---|---|---|
| Boys | 54.3 | 19.6 | 17.4 | 8.7 |
| Girls | 33.9 | 28.6 | 7.1 | 30.4 |
| TOTAL | 43.1 | 24.5 | 11.8 | 20.6 |

**Types of Scoliosis (13-18 age group)**



of this age group - the occurrence almost equal to the L-C curve. This is a very different profile compared to boys of the same age group where the C curve is very dominant.

In total, the L-C curve shows a very strong occurrence with the L-S, and the R-S curves showing less than half the same occurrence. This makes a very strong case for the causality of PDSC - both are left side inclined.

**Incidence of Spinal Curvatures by Sex:**

In order to gain a better understanding of the distribution of spinal curvature types in boys and girls, we used Table 36 to depict the percentages of **total** occurrence.

**Table 36**

| | L-C | L-S | R-C | R-S |
|---|---|---|---|---|
| Boys | 60.8 | 14.5 | 16.9 | 7.8 |
| Girls | 43.9 | 22.2 | 19.2 | 14.7 |

We noted that boys exhibited 15.2% of normal - no spinal curvatures, while girls enjoyed a 14.5% incidence of normal. We found that to be statistically essentially identical.

This meant that boys had a 84.8% incidence of spinal curvatures with girls noted at 85.5%. We found these figures very high and quite surprising.

Table 37 shows the total distribution of occurrence of the four types of curves noted across both sexes.

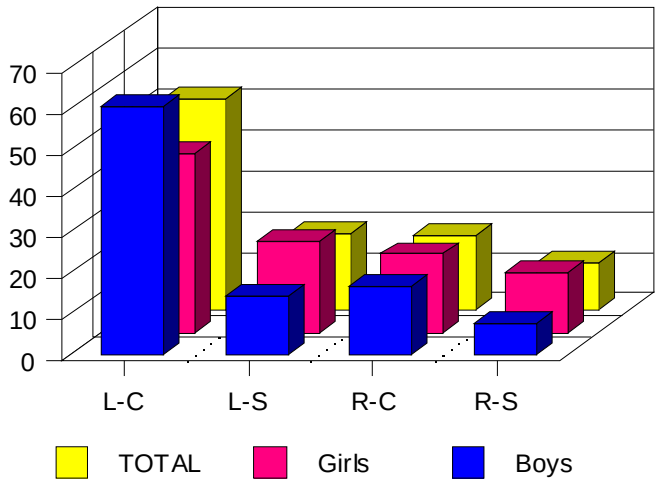
Our findings certainly challenge the long held belief that scoliosis is more common in girls than boys. As a matter of fact, the commonly upheld doctrine has been that the ratio of girls having scoliosis as compared to boys is in the neighbourhood of 80/20.

We have not found that to be the case. We have found that the incidence of scoliosis in boys as compared to girls is 84.8% and 85.5% respectively. From the statistical evidence presented, the ratio seems to be almost exactly equal. In other words, as many boys as girls are afflicted with scoliosis - and in quite significant numbers. This means that over 80% of boys and girls have some sort of an abnormal spinal curvature. In the broadest sense, we took any lateral spinal curvature of more than 5 degrees as our base-line definition of "Scoliosis".

**Table 37**

| | L-C | L-S | R-C | R-S |
|---|---|---|---|---|
| Total % | 51.7 | 18.7 | 18.1 | 11.5 |

**Incidence of Types of Scoliosis Patterns**




Many find it difficult to determine exactly when a spinal curvature should be classified as "Scoliosis". Some feel it should be so called when it reaches 20 degrees. Some feel that 8 or 10 degrees should be the enchanted number. If that criteria was to be followed, it would translate into a conundrum where a child whose spinal curvature measures 19.5 degrees for example, would be mis-diagnosed as not having scoliosis, by definition. There is little congruency and agreement in the scientific community regarding an adequate definition of what constitutes an agreeable numerical definition of this occurrence.

For the purpose of clarification and uniformity of acceptance within the profession, we felt that any lateral spinal curvature of 5 degrees or more should be classified as Scoliosis, and that it should be given some degree of numerical latitude so as not to be restrictive.

**Spinal Degeneration**

There seems to a mystical aura of an unmentionable taboo surrounding the issue of spinal degeneration (SD) in children. Clinically and even ethnically and ethically, spinal degeneration has been universally accepted as an integral consequence of aging. This is one of the reasons why osteoarthritis is ill suited, by society, to encompass children - no one expects it. Yet it is the product of various pathobiomechanical alterations in joint function.[99] It has been incorrectly regarded for years as a "wear and tear" sequella to a traumatic incident.[99-106]

Any notion or thought even remotely associated with attenuating, arresting, or, most certainly, reversing this condition, has been looked upon until recently as some exalted "heresy."[99,105] And those who spoke of such things have been prosecuted.[100]

We have found that the process of degeneration has to start somewhere. In the adult we often see the end product of that process - the beginnings are most often seen in children.[99] Lawrence mentioned that it can be noticed in 35% of the population by age 30. He found a 10.0% incidence of radiologically identifiable osteoarthritis in a 15 to 24 years old age group.[101]

In order that the reader may have a clear understanding of the issues involved, we felt it would be prudent to address the commonly held parameters of what constitutes spinal degeneration (SD) as identified radiologically, and as seen from the perspective of the vertebral subluxation model.

Clinically, SD - osteoarthritis, has been compartmentalised into four advancing stages or phases - each essentially blending into a continuous process terminated only until recently by ankylosis.[99,102,104,105] This concept has been applied and refined by others into a construct of damage initiated by the vertebral subluxation.[99,102,103]

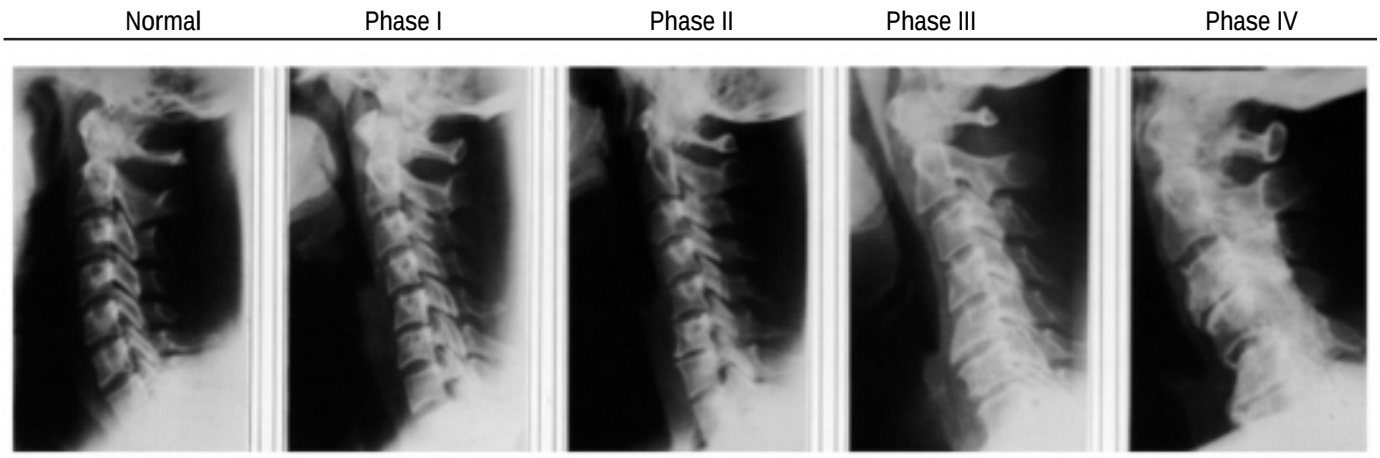
An example of this progressive concept is presented in Figure 1 courtesy of Professional Design Group;

**Phases Of Progressive Spinal Degeneration**

**Phase I:**

Phase I is characterized mainly by unit instability which results in loss of biomechanical and neurological integrity. There is radiological evidence of obvious vertebral subluxation or kinesiopathology.

**Figure 1 - Phases of Progressive Spinal Degeration**




**Phase II:**

Phase II is characterized radiologically by an alteration in disc height, osteophyte formation, articular sclerosis, and a general increase in the severity of the vertebral subluxation complex.

**Phase III:**

Phase III is characterized by massive spur formation, facet sclerosis and eburnation, loss of congruity of articular surfaces, disc collapse, and the onset of vertebral deformity.

**Phase IV:**

Phase IV is characterized by loss of form and function of the vertebral units, by ankylosis, bone deformation and necrosis, and by calcification of most spinal ligaments.

We looked to our sample of children for evidence of degeneration. Table 38 presents the incident rates expressed as percentages of occurrence;

You will notice that we did not use the Phase III criteria as we know of no child with a degenerative condition advanced to that point. It is interesting to note that as children accrue time, the percentage of those with no degenerative changes tend to decrease. This has led other researchers to assume that SD is a time/age process. However, we now know that SD is time related but not dependant.[99,104,106]

The corollary of this is also true - as children age, the incidence of SD tends to increase. By the time someone has reached the age of 70, the condition seems almost universal.[101]

If we look at all the graphs and statistical tables, one can safely state that the process of degeneration tends to increase in incidence as children age. But we must caution the reader not to reach the same assumed conclusions that have hampered understanding of this process for decades.

Very simply, if SD was the product of aging, then all children would manifest SD by late teens. That is simply not the case.

The precipitating factor in SD and IVD degeneration is considered by most clinicians to be attributable to either a gross biomechanical derangement of the vertebral motor unit, or, more subtly and more commonly, to microtraumatic events, ie., biomechanical alterations of function - the vertebral subluxation.[99,102,105]

The initiating and common denominator in this degenerative process is an alteration in the normal biomechanics and functional stress of load transduction of involved spinal segments.[107-180] It is seen as a cumulative response to microtrauma which, once started, with the passage of time, tends to accelerate into a series of progressive stages.[174-183]

There is a shift in the axis of rotation in the involved vertebral segments, which produces a unilateral fixation, a contralateral hypermobility, and an alteration in both, the stress of weight transfer, and in the dissipation of vertical force. These factors increase and alter the adaptive capability of the posterior zygapophyseal articulations, the capsular supportive elements, and the annular matrix of the IVD. This intrinsic kinesiopathology eventually leads to tearing and fragmentation of the annular fibers with effusion of sequestrated nuclear material into these annular fissures in advanced stages.[180-195]

This process gives rise to an alteration in discal function and compressibility, producing articular telescoping and disarray, further advancing the pathobiomechanical state of the motor unit. The innate tissue response is to add order and stability. Hence the formation of traction and claw spurs with the eventual goal of ankylosis.[99,105,147,175-195]

The initiating process in SD is on a microscopic and molecular plane - the process is commenced by a change in the microenvironment of the chondrocyte.[105,106] Once this is initiated, the process is inexorably progressive to ankylosis, unless it is interfered with. Correction of vertebral subluxation has been shown to interfere with this process thereby making SD open not only to attenuation, but also to arrest and reversal.[99,105,106,109,194-203]

Unfortunately, SD reversal frequently goes unnoticed in private offices because many times the initial examination is not adequate or detailed enough, there is little follow-up in terms of regular progress examinations and often initial and subsequent radiological examinations are not performed.[99,183] We feel an examination of a young developing spine is of paramount importance in the early identification and recognition of PDSC and subsequent SD.

Patterns and habits of abnormal spinal and pelvic neuromuscoloskeletal and vertebral biomechanical segmental programming should be recognized early. These are the early seed-

lings of spinal osteoarthritis and should be eliminated as early as possible in life.[5,6,102,104]

**Conclusions**

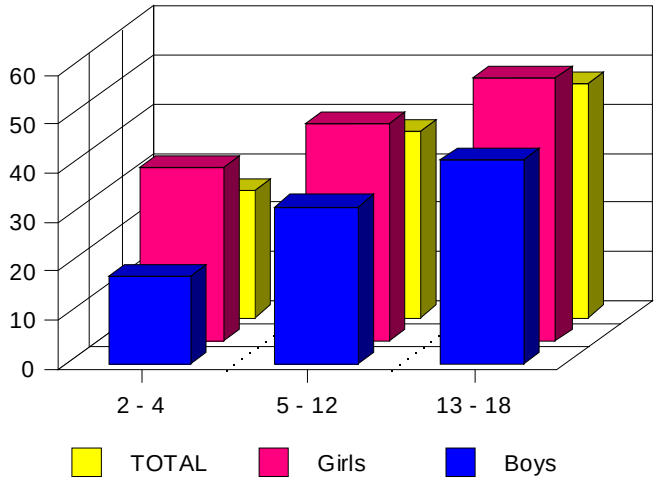
In the child, neuromuscular and functional adaptive reflex development represents a critical period of time when the young developing nervous system assimilates, differentiates, and adapts to external and internal stimuli. By means of these processes, the nervous system learns proprioceptive patterns and acquires future habits and reactions by responding to repetitive stimuli.

However, such a developing nervous system is not always able to distinguish between proper and improper stimuli; therefore it responds to both. This is the conundrum - the response is neither "good" nor "bad", but rather adaptive to the presented

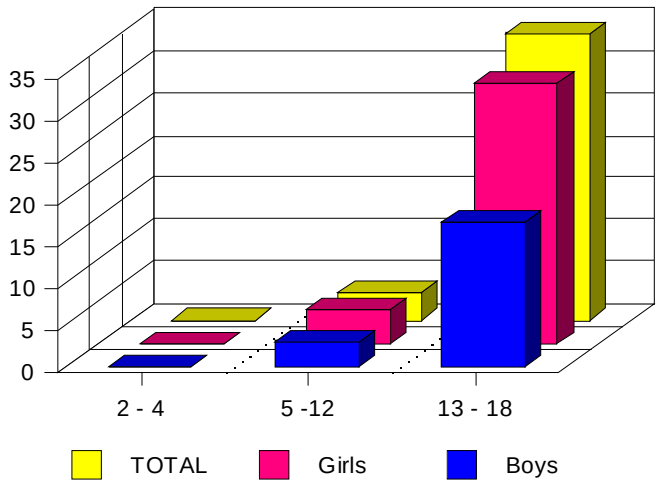
**Table 38**

| | 2-4 age group | | | 5-12 age group | | | 13-18 age group | | |
|---|---|---|---|---|---|---|---|---|---|
| Type | Boys | Girls | TOTAL | Boys | Girls | TOTAL | Boys | Girls | TOTAL |
| Phase I Cervical | 17.9 | 35.3 | 26.0 | 32.0 | 44.4 | 38.2 | 41.5 | 53.6 | 47.6 |
| Phase II Cervical | — | — | — | 2.9 | 3.9 | 3.4 | 17.1 | 31.0 | 24.1 |
| Phase I Lumbar | 2.6 | — | 1.4 | 6.3 | 8.3 | 7.3 | 22.0 | 21.4 | 21.7 |
| Phase II Lumbar | — | — | — | 4.4 | 4.9 | 4.6 | 9.8 | 13.1 | 11.5 |
| No Degeneration | 35.9 | 35.3 | 35.6 | 45.1 | 36.1 | 40.6 | 23.2 | 6.0 | 14.5 |

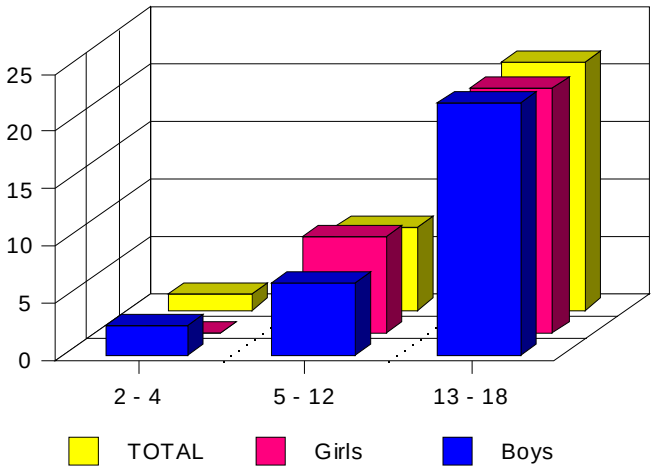
**Incidence of Phase I Cervical Degeneration**



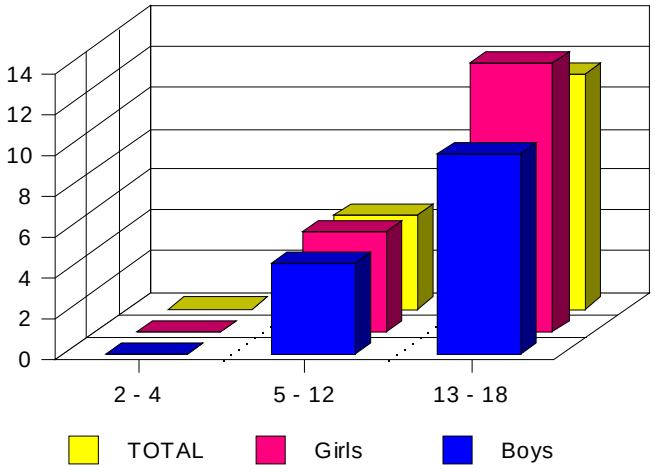

**Incidence of Phase II Cervical Degeneration**




**Incidence of Phase I Lumbar Degeneration**

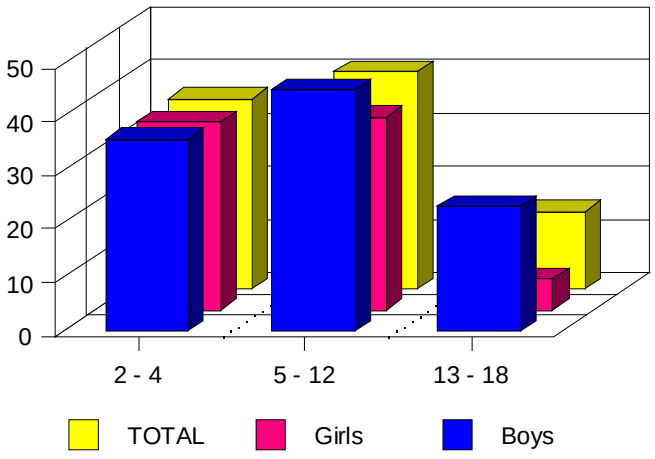



**Incidence of Phase II Lumbar Degeneration**




**Incidence of Normal**

**No Degeneration**



stimulus. These adaptive responses are remembered and patterned and thus the young nervous system is conditioned for future response.

This process of neurological "learning" or "programming" of the central nervous system with respect to locomotion, posture, proprioception, and body kinetics begins within a few short months after birth.[5,99]

As clinicians, our main course should be concerned with chronic "low-grade" efferents from the autonomic nervous system that result from and thereby not only disturb this neurological "learning" but also initiate "learned" and adaptive reflex kinesiopathology. It is then of paramount importance to eliminate any faulty programming as soon as possible.[99]

Specific corrective procedures designed to alter and change learned and adaptive kinesiopathological patterns, correct vertebral subluxations, restore normal articular function, reduce disc stress, and optimize neurological integrity should be instituted.

It is important for the clinician to resolutely strive to reach his goal - the aim being the correction of the PDSC, the vertebral subluxation, and the arrest and possible reversal of the degenerative process, not merely the achievement of temporary relief. The regimen of care should not be rushed, and patient care should not be based on symptomatology - recovery should be measured by objective findings.

Most of the children in our study sample have been placed on long-term schedules of corrective care, with very frequent initial contact - often daily. We have found that such an approach tends to change neural programming and learned patterning much faster and more completely than any other approach.[99,202,203]

This paper is the culmination of a five year effort and is intended to stimulate my fellow colleagues to re-evaluate their rationale for the care of children who cross their office thresholds, with the hope that with increased interest and enthusiasm they can give children the hope they so rightly deserve.

We are adamant in redefining the role we, as chiropractors, play in the health care of children. Too many times we have seen a family come under care of a chiropractor and the care of children is "thrown in", so to speak, as long as the parents are under care. We are obstinate when we state that children are not little adults - their physiology, metabolism, hormone, and neurodevelopmental interface is different than that of an adult. As a result, the approach we must take is one which encompasses an understanding of these fundamental differences as well as similarities.


## Acknowledgments

We would like to thank our wives and families for their guidance and patience. Our wonderful staff, Tanya, Christie, Debbie, and Dawna for their support, and all of our terrific munchkins for our stats. We would also like to thank the College of Chiropractors of Ontario for their encouragement and motivation.


## References


1. Ressel, OJ; Health With No Interference: How To Raise a Healthy Child Outside The Medical Model, New Century Publishing, 2000.
2. Dr. Larry Webster – Personal Communication
3. Illi, RW; Sacroiliac Mechanism Keystone of Spinal Balance and Body Locomotion, National College Journal of Chiropractic, (pp. 3-23), 1940.
4. Johnston, LC; Biogravitational Adaptation, Posture Research Foundation, Toronto,Ontario, 1972.
5. Ressel, OJ; Chiropractic and Children: A Rationale For Care, Int Chiro Rev May/June,1986.
6. Stiga, JP; The vertebral Subluxation Complex, Research Insights, (Unpublished Observations), 1982.
7. O'Donovan, D.; The Possible Significance of Scoliosis of the Spine in the Causation of Asthma and Allied Allergic Conditions, Annals of Allergy, (pp. 184-219), 1951.
8. Novotny, A., Dvorak, V.; Functional Disturbances of the Vertebral Column After Gynecological Operations, Manuelle Medizin, No. 3:32, 1971.
9. Lewit, K.; The Problem of Manual and Reflex Neurotherapy, Wien. Med. Wschr., 23: (pp, 473-477), 1971.
10. Lewit, K.; Liver and Gall Bladder, Manuelle Therapie, Chap. 8-63, p. 432, 1973.
11. Lewit, K.; Meniere's Disease and the Cervical Spine, Review of Czechoslovak Medicine, Vol. 7-2, p. 129, 1961.
12. Gitelman, R.; The Treatment of Pain by Spinal Manipulation, The Research Status of Spinal Manipulative Therapy, Dhew Publication, Bethesda, Maryland, p. 277, 1975.
13. Novotny, A., Dvorak, V.; Functional Disturbances of the Vertebral Column in Gynecological Practice, Manual Medicine, Vol. 4:2, 1972.
14. Goldman, SR; A Structural Approach to Bronchial Asthma, Bulletin of the European Chiropractors Union, Vol. 21, No. 3, (pp. 66-71), August 1972.
15. Hitchcock, M.; The Manipulative Approach to the Management of Primary Dysmenorrhea, JAOA, 75: 909/97, 1976.
16. Sato, A.; The Somatosympathetic Reflexes; Their Physiological and Clinical Significance. The research Status of Spinal Manipulation Therapy, NINCDS Monograph No. 15, Dhew Publication, Bethesda, Maryland, p.16, 1975.
17. Richter, HR; "The Significance of 'Entrapment Neuropathy' the Differential Diagnosis of Vertebrogenic Pain Syndromes: Manuelle Medizin, Heft 5, September – October, 1971.
18. Thomason, PR, et. al.; Effectiveness of Spinal Manipulative Therapy in Treatment of Primary Dysmenorrhea; A pilot Study, J.M.P.T., Vol. 2, No. 3, September 1979.
19. Leach, RA; The Chiropractic Theories; A Synopsis of Scientific Research, Mid-South Scientific Publishers, 1980.
20. Burchett, GD; Segmental Spinal Osteophytosis in Visceral Disease, JAOA, 67: 675/95 – 678/98, 1968.
21. Illi, FW; The Vertebral Column: Life-Line of the Body, National College of Chiropractic, Chicago, 1951.
22. Bowen, V. and Cassidy, JD; Macroscopic and Microscopic Anatomy of the Sacroiliac Joint from Embryonic Life Until the Eighth Decade. Spine 6:620-628, 1981.
23. Harrison, DE, Harrison, DD, Troyanovich, SJ.; The Sacroiliac Joint: A Review of Anatomy and Biomechanics with Clinical Implications. JMPT 1997; 20(9): 607.
24. Walker, J.; The Sacroiliac Joint: A Critical Review. Phys. Ther. 1992; 72:903-16.
25. Cichoke, AJ; Anatomy and Function of the Sacroiliac Articulations: A Review of the Literature. Chiropractic 1989; 2(3):65-70.
26. Snijders, CJ, Vleeming A., Stoeckart R.; Transfer of Lumbosacral Load to Iliac Bones and Legs. Part I: Biomechanics of Self-Bracing of the Sacroiliac Joints and its significance for Treatment and Exercise. Clin Biomech 1993: 8:285-94.
27. Snijders, CJ, Vleeming, A., Stoeckart, R.; Transfer of Lumbosacral Load to Iliac Bones and Legs. Part II: Loading of the sacroiliac Joints When Lifting in a stooped Posture. Clin Biomech 1993; 8:295-301.
28. Weisl, H.; The Articular Surfaces of the Sacroiliac Joint and their Relation to the Movements of the Sacrum. Acta Anat (Basel) 1959; 22:1-14.
29. Snijders, CJ, Vleeming, A., Stoeckart, R., Mens, JMA, Kleinrensink; Biomechanical Modeling of Sacroiliac Joint Stability in Different Postures. Spine: State of the Art Reviews 1995; 9:419-60.
30. Snijders, CJ, Vleeming, A., Stoeckart, R., Slagter AHE.; Mechanical solutions for the Problem of Fixation of the Spine to the Pelvis. Neuro-Orthopedics 1995; 17:197-202.
31. Vleeming, A., Stoeckart, R., Volkers, A., Snijders, C.; Relation Between Form and Function in the Sacroiliac joint. Part I: Clinical Anatomical Aspects. Spine 1990; 15:130
32. Miller, J., Schultz, A., Andersson, G.; Load-Displacement Behaviour of Sacroiliac Joints. J Orthop Res 1987; 5:92-101.
33. Dijkstra, PF, Vleeming, A., Stoeckart, R.; Complex Motion Tomography of the Sacroiliac Joint: An Anatomical and Roentgenological Study. ROFO Fortschr Geb Rontgenstr Nuklearmed 1989; 150:635-42.
34. Gerlack, UJ, Lierse, W.; Functional Construction of the Sacroiliac Ligamentous Apparatus. Act Anat (Basel) 1992; 144:97-102.
35. Kuchera, ML; Gravitational Stress, Musculoligamentous Strain, and Postural Alignment. Spine State of the Art Reviews 1995; 9:463-90.
36. Macintosh, JE, Bogduk, N.; The biomechanics of the Lumbar Multifidus. Clin Biomech 1986; 1:205-13.

37. Vrahas, M., Hern T., Diangelo D., Kellam J., Tile, M.; Ligamentous Contributions to Pelvic Stability. Orthopedics 1995; 18:271-4.
38. Wilder, DG, Pope, MH, Frymoyer, JW; The Functional Topography of the Sacroiliac Joint. Spine 1980; 5:575-9.
39. Sturesson, B., Selvik, G., Uden, A.; Movements of the Sacroiliac Joints: A roentgen Stereophotogrammetric Analysis. Spine 1989; 14:162-5.
40. Vleeming, A., Stoeckart, R., Volkers, A., Snijders, C.; Relation Between Form and Function in the Sacroiliac Joint. Part II: Biomechanical Aspects. Spine 1990; 15:133-5.
41. Vleeming, A., van Wingerden, JP, Dijkstra, PF, Stoeckart, R., Snijders, CJ, Stijnen, T.; Mobility in the Sacroiliac Joints in the Elderly: A Kinematic and Radiological Study. Clin Biomech 1992: 7:170.
42. Seaman, DR; Joint Complex Dysfunction, A Novel Term to Replace Subluxation/Subluxation Complex: Etiological and Treatment Considerations. J Manipulative Physiol Ther 1997; 20(9):634.
43. Lewit, K.; Functional Disorders (Fixations) of the Spine in Children, Manuelle Therapie, J.A., Barth, Leipzig, (pp. 50-54), 1973.
44. Kent, Christopher, A 3-D Model of VS, The Chiropractic Journal, January 2001
45. Masarsky, CS, Todres-Masarsky, M.: Somatovisceral Aspects of Chiropractic. An Evidence-Based Approach. Churchill-Livingstone, 2001.
46. Sturm, AK, Konig, P.; Mechanisms to Synchronize Neuronal Activity Biological Cybernetics 2001; 84:153.
47. Troyanovich, S., et al. Structural Rehabilitation of the Spine and Posture: Rationale for Treatment Beyond the Resolution of Symptons. J Manipulative Physiol Ther Vol. 21. No. 1, January, 1998.
48. Davis, GW., Bezprozvanny, I.; Maintaining the Stability of Neural Function: A Homeostatic Hypothesis. Ann Rev Physiol 2001; 63:847.
49. Pert, CB, Dreher, HE, Ruff, MR; The Psychosomatic Network: Foundations of mind-body medicine. Alternative Therapies 1998; 4(4):30.
50. Solinger, AB; Oscillations of the Vertebrae in Spinal Manipulative Therapy. J Manipulative Physiol Ther 1996; 19:238-43.
51. Roberts, S., Eisenstein, SM, Menage, J., Evans, EH, Ashton, IK; Mechanoreceptors in Intervertebral Discs: Morphology, Distribution, and Neuropeptides. Spine 1995; 20:2645-51.
52. Yamada, H., Honda, T., Kikuchi, S., Sugiura, Y.; Direct Innervation of Sensory Fibers from the Dorsal Root Ganglion of the Cervical Dura Mater of Rats. Spine 1998; 23(14):1524.
53. Borregard, PE; Neurogenic Bladder and Spina Bifida Occulta: A Case Report. J Manipulative Physiol Ther 1987; 10(3).
54. Leboeuf, C., Brown, P., Herman, A., Leembruggen, K., Walton, D., Crisp, TC; Chiropractic Care of Children with Nocturnal Enuresis: A Prospective Outcome Study. J Manipulative Physiol Ther 1991; 14(2).
55. Reed, WR, Beaver, S., Reddy, SK, Kern, G.; Chiropractic Management of Primary Nocturnal Enuretic Children. Proceedings of the National Conference on Chiropractic and Pediatrics. 1993 October, (pp. 64-82).
56. Blomerth, PR; Functional Nocturnal Enuresis. J Manipulative Physiol Ther 1994; 17(5).
57. Reed, WR, Beavers, S.; Reddy, SK; Kern, G.; Chiropractic Management of Primary Nocturnal Enuresis J Manipulative Physiol Ther 1994; 17(9): 596-600.
58. Graham, RL, Pistolese, RA; An Impairment Rating Analysis of Asthmatic Children Under Chiropractic Care. J Vertebral Subluxation Res 1997: 1(4): 41-8.
59. Masarsky, C., Weber, M.; Chiropractic and Lung Volumes—A Retrospective Study. ACA J of Chiropractic 1986; 23(9): 65-8.
60. Kessinger, R.; Changes in Pulmonary Function Associated with Upper Cervical Specific Chiropractic Care. J Vertebral Subluxation Res 1997; 1(3): 43-9.
61. Nielsen, NH, Bronfort, G., Bendix, T., Madsen, F., Weeke, B; Chronic Asthma and Chiropractic Spinal Manipulation: A Randomized Clinical Trial. Clin Exp Allergy 1995; 25(1): 80-88.
62. Hviid, C.; A Comparison of the Effect of Chiropractic Treatment on Respiratory Function in Patient´:'s With Respiratory Distress Symptoms and Patients Without. Bull Eur Chiro Union 1978; 26, 17-34.
63. Vange, B.; Contact Between Preschool Children with Chronic Diseases and the Authorized Health Services and Forms of Alternative Therapy. Ugeskr Laeger 1989; 151(28): 1815-8.
64. Mellin, G., Harjula, R.; Lung Function in Relation to Thoracic Spinal Mobility and Kyphosis. Scand J Rehabil Med 1987; 19(2):89-92.
65. Nilsson, N., Christainson, B.; Prognostic Factors in Bronchial Asthma in Chiropractic Practice. J Aust Chiropractic Association 1988; 18(3): 85-7
66. Jamieson, JR, Leskovic, K., Lepore, S., Hannon, P.; Asthma in a Chiropractic Clinic: A pilot Study. J Aust Chiropractic Association 1986; 16(4): 137-43.
67. Abulhoson, RS, Morray, BH, Llewellyn, CE, Redding, GJ; Passive Smoke Exposure Impairs Recovery After Hospitalization for Acute Asthma. Arch Pediatr Adolesc Med 1997;151(2):135-9.
68. Environmental Tobacco Smoke: A Hazard to Children. American Academy of Pediatrics Committee on Environmental Health. Pediatrics 1997; 99(4):639-42.
69. Drazen, JM, Israel, E., Boushey, HA, Chinchilli, VM, Fahy, JV, Fish, JE, Lazarus, SC, Lemanske, RF, Martin, RJ, Peters, SP, Sorkness, C., Szefler, SJ; Comparison of Regularly Scheduled with As-Needed Use of Albuterol in Mild Asthma. N Engl J Med 1996;335:841-7.
70. Kemp, T., Pearce, N., Fitzharris, P., Crane, J., Fergusson, D., St. George, I., Wickens, K., Beasley, R.; Is Infant Immunization a Risk Factor for Childhood Asthma or Allergy. Epidemiology 1997; 8(6): 678-80.
71. Odent, MR, Culpin, EE, Kimmel, T.; Pertussis Vaccination and Asthma: Is There a Link? JAMA 1994; 272(8): 592-3.
72. Classen, B.; Personal Communication.
73. Diodati, C.; Personal Communication.
74. Kokjohn, K., Schmid, DM, Troiano, JJ, Brennan, PC; The Effect of Spinal Manipulation on Pain and Prostaglandin Levels in Women with Primary Dysmenorrhea. J Manipulative Physiol Ther 1992; 15(5): 279/Medline ID: 92308764.
75. Thomason, P., Fisher, B., Carpenter, P., Fike, G.; Effectiveness of Spinal Manipulative Therapy in Treatment of Primary Dysmenorrhea: A Pilot Study. J Manipulative Physiol Ther 1979; 2:140 5.
76. Baughman, Fred; Personal Communication.
77. ADHD Fraud Web Site: //home.att.net/~fred-alden.
78. Incao, Philip, The Reason for Childhood Diseases, Alive Magazine, 2001
79. Weiner, H.; The Dark Side of Immunizations, Science News, December 1987.
80. Jordan Report, 1995.
81. van Breda, WM, van Breda, JM; A Comparative Study of the Health Status of Children Raised Under the Health Care Models of Chiropractic and Allopathic Medicine. J Chiro Res 1989; 5:101-3.
82. Takahashi, H., Miura, M., Honjo, I., Fujita, A.; Cause of Eustachian Tube Constriction During Swallowing in Patient's with Otitis Media with Effusion. Ann Otol Rhinol Laryngol 1996; 105 (9); 724-8.
83. Froehle, RM; Ear Infection: A Retrospective Study Examining Improvement From Chiropractic Care and Analyzing for Influencing Factors. J Manipulative Physiol Ther 1996; 19(3): 169-77.
84. Robertson, LM, Marino, RV, Namjoshi, S.; Does Swimming Decrease the Incidence of Otitis Media? J Am Osteopath Association 1997; 97(3): 150-2.
85. Fysh, PN; Chronic Recurrent Otitis Media: Case Series of Five Patients With Recommendations for Case Management. J Clin Chiro Ped 1996; 1(2):6.
86. Ballantyne J. The ear in Paediatric Practice . Practitioner 1985; 229(1407):809-12.
87. Barbara LOE-Fisher; Personal Communication.
88. Gutman, G., Blocked Atlantal Nerves Syndromes in Babies and Infants, Manuelle Medizin, 1987, 25, (pp 5-10).
89. Olson, AL, Klein, SW, Charney, E., MacWhinney, JB Jr, McInerney, TK, Miller, RL, Nazarian, LF, Cunningham, D.; Prevention and Therapy of Serous Otitis Media by Oral Decongestant, a Double-Blind Study in Pediatric Practice. Pediatrics1978; 61(5): 679-84.
90. Purse, FM; Manipulative Therapy of Upper Respiratory Infections in Children. J Am Osteopath Assoc. 1966; 65(9):964-72.
91. Danbert, RJ, Scoliosis: Biomechanics and Rationale for Manipulative Treatment. J Manipulative Physiol Ther 1989; 12(1) 38-45.
92. Yekutiel, M., Robin, GC, Yarom, R.; Proprioceptive Function in Children with Adolescent Idiopathic Scoliosis. Spine 1981; 6(6): 560-6.
93. Maiocco, B., Deeney, VF, Coulon, R., Parks PF Jr; Adolescent Idiopathic Scoliosis and the Presence of Spinal Cord Abnormalities. Preoperative Magnetic Resonance Imaging Analysis. Spine 1997:22(21):2537-41.
94. Veldhuizen, AG, et al., The Aetiology of Idiopathic Scoliosis: Biomechanical and Neuromuscular Factors. Eur Spine J 2000; 9:178
95. Crean JKG, et al., Matrix metalloproteinases in the human intervertebral disc: role in disc degeneration and scoliosis. Spine 1997;22(24):2877
96. Cheng JCY, et al., Posterior tibial nerve somatosensory cortical evoked potentials inadolescent idiopathic scoliosis. Spine 1998:23(3):332
97. Meior MD., Klein MP, et al., Fiber transformations in multifidus muscle of young patients with idiopathic scoliosis. Spine 1997;22(20):23577
98. Evans SC, et al., MRI of idiopathic juvenile scoliosis. A prospective study. J Bone Joint Surg Br 1996 Mar; 78(2):314-317
99. Ressel, OJ, Disc Regeneration: Reversibility is Possible in Spinal Osteoarthritis, Int Chiro Rev April 1989.
100. College of Chiropractors of Ontario VS Ressel, Ruling in favor of Ressel, 1989
101. Lawrence, JS, et al., Osteoarthritis; Prevalence in the Population and Relationships Between Symptoms and X-Ray Changes. Ann Rheum Dis. 25:1-24, 1966.
102. Renaissance International, Self published manuscript, 1981
103. Professional Design Group, Burlington, Ontario, 1985
104. Hadley, LA; Anatomico-Roentgenographic Studies of the Spine. C Charles Co, Springfield, 1981.
105. Bland, JH; The Reversibility of Osteoarthritis, AM J Med 75:16-26, 1983.

106. Bland, JH, Cooper, SM; Osteoarthritis: A Review of the Cell Biology Involved and Evidence forReversibility. Management Rationally Related to Known Genesis and Pathophysiology. Sem Athritis Rheum 14(2):106-133, 1984.
107. Plaugher G, et al, A Retrospective Case Analysis of Pretreatment and Comparative Static Radiological Parameters Following Chiropractic Adjustments. J. Manipulative Physiol Ther 1990; 13:498-506
108. Goldberg MS, et al, The Ste-Justine Adolescent Idiopathic Scoliosis Cohort Study. Part I: Description of the Study. Spine 1994; 19:1551-1561
109. Cassidy, JD; Roentgenological Examination of the Functional Mechanics of the Lumbar Spine in Lateral Flexion. J Can Chiro Assoc 20(2):13-6, 1976.
110. Farfan, HF; Symptomatology in Terms of the Pathomechanism of Low Back Pain and Sciatica (pp 171-185). Modern Developments in the Principles and Chiropractic. New York: Appleton-Century-Crofts, 1980.
111. Kirkaldy-Willis, WH, et al. Pathology and Pathogenesis of Lumbar Spondylosis and Stenosis (pp 169-180). San Francisco: Radiology Research and Education Foundation, 1983.
112. Wright J.; Mechanics in Relation to Derangement of the Facet Joints of the Spine. Arch Phys Ther (pp.201-206), April 1944.
113. Spurling, RG; Lesions of the Cervical Intervertebral Disc. Thomas, Springfield, 1956
114. Goldthwait, JE; Body Mechanics. Lippincott, Philadelphia, 1934.
115. Hadley, LA; Anatomica-Roentgenographic Studies of the Spine. C Thomas Co, Springfield, 1964.
116. Sokoloff, L.; Experimental Studies in Degenerative Joint Disease. Bull Rheum Dis 14:317-318, 1963.
117. Kirkaldy-Willis, W., Farfan, HE; Instability of the Lumbar Spine. Clin Orthop (165):110-123, 1982.
118. Anderson, GB, Buerger, AA, et al (eds). Epidemiology of Low Back Pain. Empirical Approaches to the Validation of Spinal Manipulation. C Thomas Co, Springfield, 53-70, 1985.
119. Kramer, J.; Intervertebral Disc Diseases, Causes, Diagnoses, Treatment, and Prophylaxis. Year Book Medical Publishers Inc., Chicago, 1981.
120. Kirkaldy-Willis, WH; Managing Low Back pain. Churchill Livingstone, New York, 1983.
121. Plangger, C, et al. Back Pain with Disc Herniations and Inflammatory Process; Diagnosis and Therapy. Z Allg Med 59:1715-1718, 1983.
122. Brinckmann, P.; Pathology of the Vertebral Column. Ergonomics 28(1):77-80, 1985.
123. Windsor, H.; Sympathetic Segmental Disturbances. The Evidence of the Association in Dissected Cadavers of Visceral Disease with Vertebral Deformities of the same Sympathetic Segments. Med Time 49:1-7, 1921.
124. Hult, L.; The munkfors Investigation. A Study of the Frequency and Cause of Stiff Neck Brachalgia and Lumbago-Sciatica Syndromes. Acta Orthop Scand (Suppl 16) 1954.
125. Bick, EM; Vertebral osteophytosis in the Aged. Clin Orthoped 26:50-53, 1963.
126. Friedenberg, et al. Degenerative Disc Disease of the Cervical Spine. J Bone Joint Surg 45A(6):1171-1178,1963.
127. Akeson, WH, Woo, SL, Taylor, TK, Ghosh, P., Bushell, GR; Biomechanics and Biochemistry of the Intervertebral Discs. Clin Orthop (129):133-140, 1977.
128. White, AA, Johnson, RM, Panjabi, MM, Southwick, WO; Biomechanical Analysis of Clinical Stability in the Cervical Spine. Clin Orthop (109):85-96, 1975.
129. Suh, CH; The Clinical Significances of Research into Spinal Mechanics. J Can Chiro Assoc 20(3):21-35,1976.
130. Vermon, H.; Static and Dynamic Roentgenography in the Diagnosis of Degenerative Disc Disease: A Review and Comparative Assessment. J Manipulative Physiol Ther 5(4):163-169, 1982.
131. Selecki, BR, Ness, TD, Limbers, P., Blum, P., Stening, WR; Low Back Pain; a Joint Neurosurgical and Orthopaedic Project. Med J Aust 60(2):889-893, 1973.
132. Koreska, J., Robertson, D., Mills DH, Gibson DA, Albisser AM; Biomechanics of the Lumbar Spine and its Clinical Significance. Orthop Clin North Am 8(1):121-133, 1977.
133. Kulak, RF, Schultz, AB, Belytschko, T., Galante, J.; Biomechanical Characteristics of Vertebral Motion Segments and intervertebral Discs. Orthop Clin North Am 6(1):121-133, 1975.
134. Nachemson, A.; Towards a Better Understanding of Low Back Pain; a Review of the Mechanics of the Lumbar Disc. Rheumatol Rehabil 14(3):129-143, 1975.
135. Videman, T., Eronen, I., Candolin, T.; Effects of Motion Load Changes on Tendon Tissues and Articular Cartilage. Scand J Work Environ Health 5(Suppl 3):56-67, 1979.
136. Posner, I., White AA, Edwards WT, Hayes WC; A biomechanical Analysis of the Clinical Stability of the Lumbar and Lumbosacral Spine. Spine 7(4):374-389, 1982.
137. Gritzka, TL, Fry, LR, Chessman, RL, LaVigne, A.; Deterioration of Articular Cartilage Caused by Continuous Compression in a Moving Rabbit Joint; a Light and Electron Microscope Study. J Bone Joint Surg (Am) 55A(8):1698-1720, 1973.
138. Lipson, SJ, Muir, H.; Vertebral Osteophyte Formation in Experimental Disc Degeneration. Arthritis Rheum 23(3):319-324, 1980.
139. Barr, JS; Lumbar Disc Lesions in Retrospect and Prospect. Clin Orthop (129):4-8, 1977.
140. Jones, MD; Cineradiographic Studies of Degenerative Disease of the Cervical Spine. J Assoc Can Radiol 7:52-55, 1967.
141. Farnfan, HF, Cossette, JW, Robertson, GH, Wells, RV; The Effects of Torsion on the Lumbar Intervertebral Joints; the Role of Torsion in the Production of Disc Degeneration. J Bone Joint Surg (Am) 52A(3):468-497, 1970.
142. Drum, DC; Conservative Management of Lumbar Degeneration; part l. J Can Chiro Assoc 14(4):8-111970.
143. Drum, DC; Conservative Management of Lumbar Degeneration; part 2. J Can Chiro Assoc 15(1):18-21, 1971.
144. Drum, DC; Conservative Management of Lumbar Disc Degeneration; Part 3. J Can Chiro Assoc 15(2):12-15, 1971.
145. Jirout, J.; The Rotational Component in the Dynamics of the C2-3 Spinal Segment. Neuroradiology 17:177-181, 1979.
146. Burkart, SL, Beresford, WA; The Aging Intervertebral Disc. Phys Ther 59(8):969-974, 1979.
147. Vernon-Roberts, B.; Degenerative Changes in the Vertebral Discs of the Lumbar Spine and their Sequelae. Rheumatol Rehabil 16:13-21, 1977.
148. Kirkaldy-Willis, WH, Wedge, JH, Yong-Hing, K., Reilly, J.; Pathology and Pathogenesis of Lumbar Spondylosis and Stenosis. Spine 3(4):319-328, 1978.
149. Johnson, RT; Current Therapy in Neurologic Disease-2. BC Decker Inc. Toronto, 1987.
150. Buerger, AA, et al; Empirical Approaches to the Validation of Spinal Manipulation. Biomechanical Properties of the Interverebral Disc (pp. 30-41). Pope MH, ed. C Thomas Co, Springfield, 1985.
151. Alexander, MJ; Biomechanical Aspects of Lumbar Spine Injuries in Athletes; a Review. Can J Applied Sport Sci 10(1):1-20, 1985.
152. Wickstrom, G.; Effect of work on Degenerative Back Disease: a Review. Scand J Work Environ Health 4(Suppl 1):1-12, 1978.
153. Jaffray, D., et al. Isolated Interverebral Disc Resorption: a Source of Mechanical and Inflammatory Back Pain. Spine 11(4):397-401, 1986.
154. Fry, J.; Facing the Facts on Back Pain. Update 31(10):785-787, 1985.
155. Kursunoglu, S., et al. What Caused the Retiree's Backache and Stiffness? J Musculoskel Med 2(8):41-44,48, 1985.
156. Nachemson, A.; Recent Advances in the Treatment of Low Back Pain. Int Orthop 9(1):1-10, 1985.
157. Dvorak, J., et al. Biomechanics and Functional Examination of the Vertebral Column (pp.1-20). Manual Medicine: Diagnostics. New York Thieme Stratton, 1984.
158. Huelke, DK, et al. Cervical Spine Biomechanics: a Review of the Literature. J Orthop Res 4(2):232-245, 1986.
159. LaBan, MM, Leek, JC, et al, Eds. Low Back Pain, Lumbosacral Strain, and Lumbar Disc Disease (pp. 309-333). Principles of Physical Medicine and Rehabilitation in the Musculoskeletal Diseases. Toronto, Grune & Stratton Inc, 1986.
160. Nachemson, A., Jayson MI, Ed. Lumbar Intradiscal Pressure The Lumbar Spine and Back Pain, 2nd ed. London, Pitman Publishing, (pp. 341-358).1985.
161. Gerzbein, SD, et al. Central Patters and Segmental Instability in Degnerative Disc Disease. Spine 10(3):257-261, 1985.
162. Blackburn, WD, Ball, GV, et al, Eds. Back Pain (pp. 320-329). Clinical Rheumatology. Toronto, WB Saunders, 1986.
163. Tencer, AF, et al. Soft tissue Strain and Facet Face Interaction in the Lumbar Intervertebral Joint;Part II:Calculated Results and Comparison with Experimental Data. J Biomech Eng 105(8):210-215, 1983.
164. Liu, YK, et al. Torsional Fatigue of the Lumbar Intervertebral Joints. Spine 10(10):894-899, 1985.
165. Leach, RA; Intervertebral Subluxation Hypothesis (pp. 35-48). The Chiropractic Theories: a Synopsis of Scientific Research, 2nd ed. Batlimore, Williams and Wilkins, 1986.
166. Jolliot, C.; Biomechanics of the Joint and Chiropractic. Eur J Chiro 33(1):13-20, 1985.
167. Dupuis, PR, et al. Radiologic Diagnosis of Degenerative Lumbar Spinal Instability. Spine 10(3):262-276, 1985.
168. Reiter, I.; Apophyseal Joint Functional Anatomy and Experimental Findings – a Literature Review. Res Forum 1(2):49-53, 1985.
169. Adams, MA, et al. Mechanical Factors in the Etiology of Low Back Pain. Orthopedics 5(11):1461 – 1465,1982.
170. Yang, KH, et al. Mechanism of Facet Load Transmission as a Hypothesis for Low Back Pain. Spine 9(6):557 – 565, 1984.

171. Panjabi, MM, Kpag, MH, Chung, TQ. Effects of Disc Injury on Mechanical Behavior of the Human Spine. Spine 9(7):707-713, 1984.
172. Bunnel, WP. Back Pain in Children. Orthop Clin North Am 13(3):587-604, 1982.
173. Hadley, LA; Anatomica-Roentgenographic Studies of the Spine. C. Thomas Co, Springfield, 1964.
174. Sokoloff, L.; Experimental Studies in Degenerative Joint Disease. Bull Rheum Dis 14:317-318, 1963.
175. Fager, CA; The Age-Old Back Problem: New Fad, Same Fallacies. Spine 9(3):326-328, 1984.
176. Wood, Ph, Jayson, MI, et al, Eds. Epidemiology of Back Pain (pp. 29-55). The Lumbar Spine and Back Pain, 2nd Ed. London: Pitman Publishing, 1985.
177. Friedenberg, ZB, et al; Degenerative Changes in the Cervical Spine. J Bone Joint Surg 41A(1):61-70,1959.
178. Billig, HE; Bone and Joint Changes Following Injury. J Int Coll Surg 19:760-762, 1953.
179. Jirout, J. Studies of the Dynamics of the Spine. Acta Rad 46:55-60, 1956.
180. DePalma, AF, Rothman, RH. The intervertebral Disc, WB Saunders, Toronto, 1974.
181. Farfan, HE, et al. The Instantaneous Centre of Rotation of the Third Limbar Intervertebral Joint J Biomech 4:149, 1971.
182. Taylor, et al. Intervertebral Disc Prolapse: A Review of Morphologic and Biomechanical Knowledge Concerning the Nature of Prolapse. Clin Orthop 76:54, 1971.
183. Carter, J.; Personal Communication: OCA Convention, 1987.
184. Jirout, J.; Studies in the Dynamics of the Spine. Acta Radiol 46:55-60, 1956.
185. Hadley, LA; Intervertebral Joint Subluxation, Bony Impingement and Foramen Encroachment with Nerve Root Change. Am J Roent & Rad Ther 65:377-402, 1951.
186. Grormley, RK; Low Back Pain with Special Reference to the Articular Facets. JAMA 101(23):1773-1777, 1933.
187. Bernstein, SA; Acute Cervical Pain Associated with Soft-Tissue Calcium Deposition Anterior to the Interspace of the First and Second Cervical Vertebrae. J Bone Joint Surg (Am) 57A(3):426-428, 1975.
188. Shealy, NC; The Role of the Spinal Facets in Back and Sciatic pain. Headache 14(2):101-104, 1974.
189. Swezey, RI, Silverman, TR; Radiographic Demonstration of Induced Vertebral Facet Displacement. Arch Phys Med Rehabil 52:244-249, 1971.
190. Scott, D.; Bird, H.; Wright, V.; Joint Laxity Leading to Osteoarthritis. Rheumatol Rehabil 18:167-169,1979.
191. Adams, MA, Hutton, WC; The Effect of Posture on the Role of the Apophyseal Joint in Resisting Intervertebral Compressive Forces. J Bone Joint Surg (Br) 62B(3):358-362, 1980.
192. Adams, M.; The mechanical Properties of Lumbar Intervertebral joints with Special Reference to the Causes of Low Back Pain. Bull Eur Chiro Union 29(4):182-189, 1981.
193. Miller, JA, Haderspeck, KA, Schultz AB; Posterior Element Loads in Lumbar Motion Segments. Spine 8(3):331-337, 1983.
194. Levine, M.; Pathogenesis and Significance of Subluxation. Chiro Internist 111(2):1-5, 1973.
195. Farfan, HF; A Reorientation in the Surgical Approach to Degenerative Lumbar Intervertebral Joint Disease. Orthop Clin North Am 8(1):9-21, 1977.
196. Paatsama, S.; Roddanen, P.; Jussila, J.; Etiological Factors in Osteochondritis Dissecans in the Canine Humeral Head Using Overloading with and without Somatotropin and Thyrotropin Hormone Treatment and Mechanical Trauma. Acta orthop Scand Dec; 46(6):906-918, 1975.
197. Ghosh, P.; Taylor, TK, Pettit, GD, Horsburgh, BA, Bellenger, CR; Effect of Postoperative Immobilization on the Regrowth of the Knee Joint Semilunar Cartilage; An Experimental Study. J Orthop Res 1(2):153-164, 1983.
198. Radin, EL; Hypothesis: Joints Can Heal. Semin Arthritis Rheum 13(3):293-302, 1984.
199. Salter, RB, Simmonds, DF, Malcolm, BW, et al. The biological Effect of Continuous Passive Motion in the Healing of Full Thickness Defects in Articular Cartilage. J Bone Joint Surg 62A:1232-1251, 1980.
200. Videman, T., et al. Effects of Motion Load Changes on Tendon Tissues and Articular Cartilage: A Biochemical and Scanning Electron Microscopic Study on Rabbits. Scand J Work Environ Health (Suppl 3) 5:56-67, 1979.
201. Heikkinen, E., Vuori, I.; Effect of Physical Activity on the Metabolism of Collagen in Aged Mice. Acta Physiol Scand 84:543-549, 1972.
202. Dr. Bobby Doesher, Oklahaven Children's Centre; Personal Communication.
203. Dr. Patrick Gentempo; Personal Communication.