XI. Pediatric Radiographic Evaluation in Chiropractic

RECOMMENDATION

Production and analysis of X-ray images for the pediatric patient are a well accepted part of clinical chiropractic practice. The PCCRP panel recommends spinal radiographs in these just as in the adult population. The guidelines put forth in Section II are recommended for pediatric patient populations.

Supporting Evidence: Clinical Studies III, IV, V, and Population Studies Class 2-4, Reliability Studies class 1 and 2, Validity Studies, and Biomechanics.

PCCRP Evidence Grade: Clinical Studies = C, D and Reliability, Biomechanics, and Validity = a.

Introduction

Pediatrics is defined by Webster's dictionary as "a branch of medicine dealing with the development, care, and diseases of children." For this section, we define children as subjects in the age range of 1 day old and 18 years old, inclusive.

The foundation of an accurate chiropractic analysis and corrective care plan is based on a history, comprehensive examination, and appropriate diagnostic radiographs. Of the three, obtaining diagnostic radiographs in the pediatric chiropractic patient is the most difficult to accomplish due to patient movement. Patience by the doctor of chiropractic with the pediatric patient pays off by allowing visual examination only detectable by radiographic imaging.

Although radiation exposure in pediatric cases has been a concern in the past, the Radiation Hormesis section of this document details the fact that radiation risks from medical x-rays are near zero and the benefits are many. However, practicing chiropractors need to use appropriate judgment in the amount of X-radiation exposure.

In fact, the U.S. Bureau of Radiological Health emphasizes the importance of clinical judgment in selecting radiographic procedures. The Bureau also recognizes the right of the attending doctor to make an assessment of risk vs. benefit in determining what is in the best interest in care for the patient. If the doctor of chiropractic feels there is a reasonable expectation of obtaining information from a radiographic examination that would affect the care of a pediatric patient, the potential radiation hazard is not a primary consideration.[1]

The following general guidelines are suggested:

1. The outcome of the radiographs study will be used in determining the nature of care administered.
2. If possible, obtain copies of prior radiographs (from other office(s)).
3. The highest film speed and cassette combination should be used when possible. Some situations may require lower screen speed to increase detail.
4. Use the manufacturer's recommended time and temperature for processing.

General Considerations

When working with a young child, the chiropractic staff should make the x-ray procedure as comfortable as possible. The first step in desensitizing a child to the experience is to explain what you plan to do in terms the child may comprehend. Show and tell allows the child to become comfortable with this procedure. The more compliant child will hold still for the necessary time to obtain a diagnostically useful film.

Radiographic procedures for children should include safety precautions. Shields should be used to protect areas sensitive to radiation when ever possible. If the shield will cover an area which needs to be visualized, then the doctor must make that determination.

Children should not be left alone during the radiographic evaluation. The survey should be performed by two people working together, to avoid the child being left alone during the radiographic evaluation. A staff member or parent of the child may be used in this position. The films should have the correct the correct name and correct side markers, and the date and time of the examination should be clearly marked.[2]

Reasons for Radiographic evaluation in children

Vertebral subluxations can be a serious health hazard at any age, the child is no exception. Radiographic examination provides vital information not available by any other means. During birth especially when forceps are used, the cephalad traction may cause tearing of ligaments, muscles, discs, and the spinal cord. This type of traction to the newborn's head and spine may subluxate the condyle-atlas, the atlas-axis and the lower cervical vertebrae. Vacuum type extractions are another type of cephalad traction. C-section type births may cause injury to any area of the spine. Less than ideal birth presentation, as with variations from a vertex such as brow or facial delivery, apply aberrant forces to the skull, cervical and thoracic spine. The newborn's pelvis and lumbar spine may be subluxated in breech births. Retrolisthesis and anterolisthesis of the cervical spine may be caused if tremendous force is applied to extract the newborn. Protracted as well as fast deliveries also deliver abnormal stresses to the skull and spinal structures.

Upper cervical instability along with atlas inversion into the foramen magnum can cause incomplete or temporary compromise to the blood supply of the upper spinal cord and brain stem. This can cause impairment of the respiratory centers in the medulla as seen in chronic intermittent hypoxia present at autopsies of SIDS cases.[3,55]

"Damage to the reticular nuclei just dorsal to the inferior olives of the brain stem can cause respiratory depression, which accounts for a large percentage of neonatal deaths, and damage to the vagus nerve may play a role in another type of infant death, termed Sudden Infant Death Syndrome (SIDS)."[4] Some additional injuries to newborns may be found in some recent literature and texts.[5-14]

There are a multitude of literature reports on injuries that are specific to birth and impact traumas.[15-75] The clinician should be aware of these possible injuries and a radiology examination may reveal if the child has sustained any of these.

The above possible injuries to the newborn's upper cervical spine indicate the need for a minimum pediatric cervical series, which includes a lateral cervical and an AP Nasium upper cervical view. The nasium view is recommended over the AP cervical radiographic view as the AP cervical view does not depict the alignment of the C0-C1-C2 complex.

Besides birth traumas, children of any age may be subjected to falls, pulling by a sibling or parent, accidents and even abuse. Since the average toddler falls down many times in one day, this and any of the previous insults may subluxate/misalign the child's spine. School age children participate in contact sports which may impact the spine and cause abnormal alignment. Gymnastics, ballet, and football along with many other activities may twist, torque or otherwise cause abnormal spinal alignment, which cause abnormal physiology, abnormal biomechanics, abnormal neurological function, disc injuries that go unrecognized,[54] and cartilage breakdown with hypermobility.[70,71] In many cases, abnormal spinal alignment does not cause an immediate

symptom, but the condition compromises nervous system integrity which may influence organ system function and general health.[72-73] This is the cross-sectional view of a patient versus the longitudinal view. The information gained from chiropractic radiographs far outweighs the inherent dangers, since the risks of medical/spinal x-rays are nearly zero or may even have a health benefit.

Pediatric Radiographic Considerations

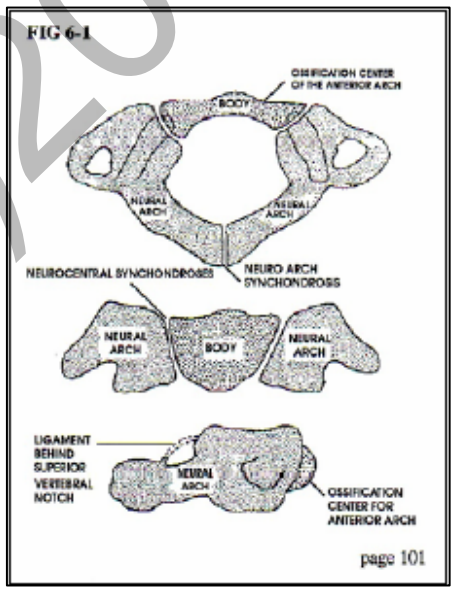
Radiographs commonly used in the chiropractic profession are of the cervical, thoracic and lumbar spines. Radiographs in children are taken in a similar manner as adult with some exceptions since children who are newborns and up to age 12 months generally cannot stand.

Depending on the child's age the x-rays may be taken with the child sitting, supine, prone, standing, leaning against the bucky, held by a shielded attendant, or 'bundled' if the infant can't be held still without these restraints. Head clamps or lead gloves are used to hold the child's skull or body in position. Ensuring patient compliance is of great value when x-raying a child. Therefore a pacifier, favorite toy, or blanket may be used during the procedure.

X-radiation safety is important for all ages and during imaging of a child. Care should be taken to shield areas not being examined. Small focal spot, collimation, speed of film, and body shields may be in combinations to protect the child. These items are taught in all Chiropractic Colleges and are the individual doctor's responsibility.

Pediatric radiographs have several inherent differences when compared to adult radiographs. In the newborn, vertebrae have three ossified parts which are united by cartilage (Figure 1). The cervical region is the last to ossify. The ossification of the posterior ring of C1 is usually completed by age three. The ossification center at the apex of the dens is not visible until the second year. Between the ages of four and seven the odontoid of C2 fuses to the body. Closure of the neurocentral union between the pedicle and the vertebral body does not occur until the fourth to fifth year. At about age 15, the secondary ring centers of Axis-C7 fuses with the primary body centers.

Figure 1



Due to the fact that the infant has a great deal of unossified bone, measurement landmarks may differ from that of an adult. On the lateral radiograph, the young child's vertebrae appear to have step-like recesses on the anterior edge (Figure 2). This is due to an annular recess that surrounds the entire body and is filled with cartilage. These indentations are occasionally seen on the lateral margins. As the child grows the vertebral bodies become more rectangular (Figure 3).

Figure 2

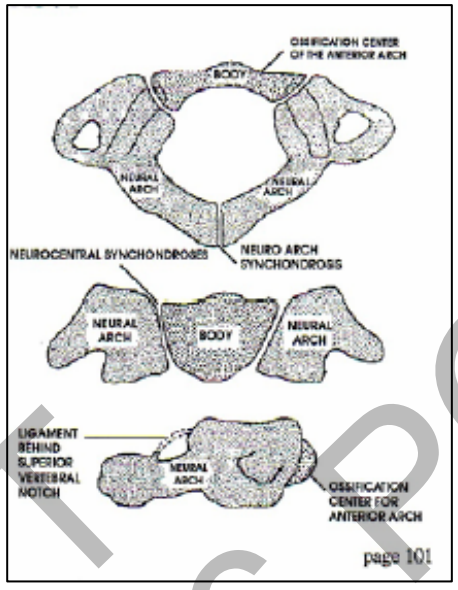
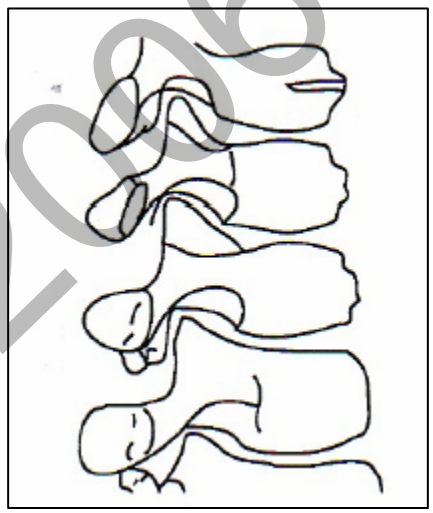


Figure 3.



The facial bones of the infant are compressed relative to those of the adult. The growth of the facial bones in the adult gradually increases the angle between the radiographic base line and the pediatric base line. This will affect the angle at which the nasium radiograph is taken. The infant's x-ray will have a smaller angle whereas older children will have a slightly larger angle.

Due to the normal hyper-mobility of the cervical spine in children, care must be taken to accurately analyze the lateral cervical radiograph. It is generally a normal finding to see a slight

forward shift in C2 on C3 in flexion. This is known as "Pseudo-subluxation" and is considered a normal variant. The DDx is the spinolaminar line is intact with a pseudo-subluxation, whereas it is not with a true subluxation. Also, C3 may shift forward on C4 in flexion. In a normal radiograph, this forward shift of the vertebrae disappears in extension. If it persists, it is an abnormal finding.

The lumbar spine is the first to ossify during the first year of life. Some of the vertebrae are still cartilage until puberty, this includes the upper and lower surfaces of the bodies, the tip of the transverse, and the spinous processes. The sacrum may not fuse into a single mass until the 12th and 25th year.

In 2005, Biedermann wrote a pediatric text for the Manual Therapist, in which he discusses pediatric radiology in some detail.[76-78] He stresses the fact that "the cervical region of the vertebral spine is the most complex and also the functionally most important in children."[76] He also stated that "there are cases where X-ray evaluation in the lumbar and pelvic girdle is essential."[76]

Biedermann also noted that some in the manual therapy field take "the obvious and radial consequence to disregard X-ray analysis completely." He stated that "this argument is facilitated by the fact that many of those applying manual therapy to the vertebral spine often to not have ready access to radiographs, as is the case for many physiotherapists."[76] In Chiropractic, this is not the case because DCs have radiology privileges in English speaking countries.

From Biedermann, "[Children] show a complex pattern of inborn and acquired features, the main morphological problems in newborns are congenital variants found in this evolutionarily volatile region."… "A second aspect of the functional analysis of the X-ray pictures of small children is the dominance of functional over morphological details". "In the small child – and even more so during the first year – it is more often the (mal) function which determines the way morphology will differentiate." … We see more and more examples where a timely intervention mobilizes the functional situation and imminent morphological pathology could be averted. The functionally fixed posture results in a morphological response. This is one major reason why the functional analysis of the X-ray pictures is of such paramount importance in dealing with our young patients."[76]

Biedermann also noted that, in the pediatric patient, important anatomical deviations are too elusive to be found clinically and thus, radiographs are needed. He also stated that it is not possible to find out beforehand, either in the medical history or findings from palpation, where it would make sense to take a radiograph and where not. He noted that it is not possible to define pediatric "risk groups". He stated that it is not possible to determine who then should have a radiographic examination, nor possible to exclude groups of pediatric patients.

Radiographic Imaging Views

There are some additional reports of C0-C1-C2 anomalies and pathologies that may apply to the pediatric upper cervical spine.[79-83] These situations may require additional radiographic views in pediatric cases. To completely determine a child's problem, cervical radiographs may include the lateral cervical, nasium, A-P open mouth, Vertex, Base posterior, flexion-extension and/or obliques. Thoracic radiographs include lateral thoracic, A-P thoracic, flexion-extension, and/or oblique views. Radiographic studies of the Lumbar, sacrum, and pelvis may be taken from the lateral, obliques, and A-P views. The views necessary to determine appropriateness and corrective chiropractic care program is determined by the attending chiropractor and is done on a case by case basis.

Indications Specific to Pediatric Radiograph

In addition to the "Indications for Radiography in Children and Adults" provided in Section I of this document, there are several indications for spine radiography that are specific to pediatric cases. These include, but are not limited to the following:

1. Seizures
2. Difficulty breathing
3. Colic
4. Delayed suckling
5. Delayed bowel movement
6. Delayed awareness, such as following with the eyes
7. Delayed physical maturity, such as rolling over, crawling, and/or walking
8. Delayed speech
9. Lazy eye, one eye rotated inward or outward.
10. Torticollis
11. Any fixed posture (e.g., abnormal lateral cervical curvatures, scoliosis, extension postures)

Validity of Radiology in Pediatric Cases

This section is still be written.

Pediatric Outcome Studies Utilising Spinal Radiography

In 2004, Bastecki et al[84] reported improvement in an 8 year pediatric case with ADHD. At 5 years of age the child was diagnosed with ADHD and treated by an MD pediatrician unsuccessfully with Methylphenidate (Ritalin), Adderol, and Haldol for three years. At age 8, the child received 35 CBP chiropractic treatments over the course of 8 weeks. A change from a 12° C2-C7 kyphosis to a 32° C2-C7 lordosis was observed at post-treatment. During chiropractic care, the child's facial tics resolved and his behavior vastly improved. After 27 chiropractic visits, the child's pediatrician stated that the child no longer exhibited signs and symptoms of ADHD. The authors' stated that changes in structure and function appear to be related to the correction of cervical kyphosis.[84]

In 2000, Aguilar et al[85] reported on a cohort study of 26 autistic children. The children were put on a 9 month care program of adjustments with Grostic and Orthospinology techniques. Objective data were collected through brainstem evoked potential (BESP's) recordings, pre and post x-ray films, a dual probe infrared heat recording graph instrument, and a supine leg length check analysis. Subjective data were collected through both a Modified Autism Checklist and Childhood Autism Rating Scale (CARS). Preliminary data collected indicated a correlation with the atlas adjustment and behavior improvements in autistic children.

In 2000, Mayer Hunt[86] reported on a case study of a twelve year old girl with a 7 year history of a right cystic hygroma and concomitant daily morning neck pain and headaches. Her history involved 4 surgical procedures which failed to contain the mass or relieve her severe sinus drainage. Cervical X-rays were performed with a noted loss of lordosis. Orthospinology technique films of the nasium/vertex views were analyzed with C1 left 1º with 3º of anterior rotation C2 left 1º with 12º rotation. Lower cervical angle was measures at 1º to the right. Care was delivered at 3x4 weeks then 2x2 weeks, 1x8 weeks then 2x/month for 8 months. Following seven months of chiropractic care, the mass remised and had not returned on two years of follow up. The neck pain and headaches also resolved.

In 1998, Killinger and Azad[87] reported on a case study of an 11 month old male with severe complicated late onset infantile colic. The infant had been unable to consume solids for a period of four months and suffered from severe constipation. In addition the subject demonstrated extreme muscular weakness and lack of coordination. The baby was unable to crawl, stand, or walk and was greatly unresponsive to his surroundings. X-rays performed were AP, Lateral and APOM cervical spine with a confirmed presence of atlas vertebrae malposition (ASLA) as determined by radiographic line analysis discussed by Roberts in his 1994 paper. Two toggle recoil adjustments were delivered with improvements in the ability of the child to hold his head up, play happily for 2.5 hours without weakness or crying. The infant slept through the night which had not been seen prior to the adjustments. The parents also noted the baby was more alert, overall with limb motion – more active and more coordinated with an active interest in his surroundings. One week after presenting, the baby was able to eat his first solid food in five months and keep it down as there was no vomiting. Bowel movements occurred without the aid of an enema.

In 1997, McCoy et al[88] reported on a case study of a 4 year old child presented after trauma with a "cock-robin" position which is typical for an atlantoaxial rotary fixation. Radiographs of APOM, APLC and lateral views were obtained. A left lateral head tilt with right cervical spine convexity was noted. Asymmetry of the paraodontiod spaces were noted with an atlas overhang of left lateral mass on C2 by 3mm. Axis was rotated spinous right. The lateral projection noted a tilt of atlas. Stairstepping of Georges line began at C3. Anterior displacement of posterior cervical line is noted at the posterior tubercle of the atlas and posterior displacement of the spinolaminar line was noted at C2 and C3. Adjustments were delivered and within two weeks following spinal adjustments, the patient returned with complete resolution of symptoms.

In 1997, Hyman[89] reported on a two month old with a history of obstetrical brachial plexus injury at the level of C5-C6 presented for chiropractic care. Radiographs were obtained by AP full spine and lateral spine views. A left diaphragmatic hemiparesis was noted. Palmer Upper Cervical Specific line analysis and the Gonstead technique line analysis revealed a C1 misalignment on the right (ASR), a PI misalignment of C5 and a right PI ilium. Chiropractic care was delivered accordingly to the listed areas. Detailed progression with observations, were noted with resolution of the infant's condition after 8 visits.

In 1996, Anderson-Peacock[90] reported on a case series of children with headaches. Case one did not have X-rays. Case two involved a 4 year old with the medical diagnosis of classical migraines at a frequency of one per week with duration of one full day. He had X-rays taken with a left translation of the head relative to the thoracic cage, an anterior cervical gravity line; C1 left lateral, C6 posteriority relative to C7, superiority of C0-C2 on the right and C6-T4 also on the right. T2/3 were rotated spinous right, L1-L33 rotated spinous left. Adjustments were delivered by Diversified technique and after 6 weeks of care, there were no further migraines.

Case three[90] was of a 7 year, 11month old, who presented with cervicogenic evening onset frontal headaches precluding her from falling asleep. These occurred at a frequency of 1 to 2 times per week. Cervical x-rays found kyphosis from C4-7, C1 lateral right, C6 PI and T2-4 rotated spinous right. Diversified technique was used and subsequent to two weeks of care, there was a reduction of headaches. After follow up at four months, she had experienced a total of two headaches, and as an additional improvement, she had no ear pain which was also noted in the history.

Case four[90] was a 13 year 11 month old who was medically diagnosed with migraines for 5 years at a frequency of 2 migraines per month. Cervical X-rays noted kyphosis of the cervical

spine with anterior cervical gravity line. C0-C1 were right lateral, C3 and C6-7 were in a relative posterior position, C5 was rotated spinous left and T2 rotated spinous right. Vertebral body unleveling was noted at T1-3 inferior on the right. Diversified care began and within two weeks he experienced no headaches until a fall on his coccyx at two months at which time they returned. They were reduced again after three weeks of care

Case five[90] was a 15 year old with general and orbital headaches of a 'several times per week' frequency over a period of 10 months. Bilateral eye pain with numbness and paresthesia, a recurrent stiff neck, left sinus pain and numbness over the left maxillary sinus region for a number of weeks was also noted. Specialists had ruled out other pathology. Cervical X-rays APOM, APLC, and Lateral noted an interruption of George's line at C4-5 with anterior cervical gravity line. C1 was left lateral, C6PI, T1/2 spinous rotation right. Diversified adjustment was delivered and within two weeks she had no facial numbness and no headaches and greatly reduced eye pain.

In 1996, Hyman[91] reported on a case of a child with petit mal seizures. Uncontrolled by medication petit mal seizures of 4-6 per hour and toeing-in with leg pain were noted on the first visit. Additionally, involuntary movement of the head and upper extremities was noted. X-rays noted a double apex curve measured by Cobb. The lumbar curvature was 10 degrees with the apex at L3 and the thoracic was 7 degrees apex at T5. The spinal subluxation listings were ASRA, T4 PI with spinous rotation left, L3 PL and pelvis left PIEX and right ASIN. Table assisted low force high amplitude adjusting was performed on a side posture drop headpiece using the Palmer Toggle recoil technique. These adjustments were given for upper cervical and full spine adjustments on a segmental drop table using Thompson technique. The frequency of seizures dropped to 2-3 per two hours by the third visit and by the tenth visit dropped to 1-2 seizures every three to four hours. After 2 months of chiropractic care, the patient was off seizure medication, and experiencing zero to 1 seizure per day. In addition the leg pain resolved and toeing-in reduced.

In 2004, Ressel, a DACBR, and Rudy[92] reported on an exhausting review of 650 pediatric patients under chiropractic care. In addition to examination and other diagnostic procedures, radiographs were obtained on the patients. The authors describe a Pelvic Distortion Subluxation Complex (PDSC) that was seen in 96% of the children. It was reported that the PDSC was "a common denominator in complaints plaguing our sample of children." They also discuss that the PDSC were correlated with complaints that were mainly somatic, visceral and immune related.

Alcantara et al[93] report on a 2-year old girl who presented with her mother for symptoms associated with recent onset myasthenia gravis following a motor vehicle collision. Adjustments were provided to the cervical and sacral spines based in part upon specific spinal listings measured form AP radiographic images of the spine. The toddler responded well to care and was free of symptoms following 5 months of care. For the first 3 ½ months of care the girl was adjusted 2-3 times a week. Comparative x-rays were taken and evaluated with reported improvement.

In 1997, Peet[94] reported a pediatric case of an 8 year old with A.D.D. Chiropractic evaluation and care (CBP Technique for 4 months) were initiated after three years of traditional medical care consisting of Ritalin™ and Prozac™ and behavior modification. Spinal radiographs were obtained: (a) lateral cervical showed anterior head translation and a reduced atlas plane line to horizontal (10º), (b) the nasium revealed an Against pattern of left UA = 2° and right LA = 6.5°, with a left CD angle = 8º at mid neck, and with a UTC angle = 6º at T2 area. The child's

head posture was a right lateral translation, right lateral flexion, and anterior head translation. There was a left lateral flexion of the thoracic cage. After 12 visits over 2 months (2x week for 1 month, 1 x week for 2 months), post radiographic measurements were: UA = ½ º, LA = 1º , CD = 0º. After 3 weeks, the child's parents discontinued all medications. After 6 weeks, the child's behavior was graded in a school setting. He had improved in cognitive skills, concentration on tasks, was less aggressive, and improved ability to control his emotions. The child showed marked improvement for 4 more months.[94]

In 1997, Peet[95] reported a pediatric case with chronic respiratory infections, ADHD, and chronic fatigue. The 8 year old male had suffered a birth trauma (forces and vacuum extraction) and was a premature baby. He was diagnosed by his MD with ADHD, and had constant throat congestion and raspy voice, seizures at time of ear infections, flat feet, chronic fatigue, loss of physical stamina, and low back pain which started immediately after birth. He was on Phenabarbitol™ for seizures. The CBP Technique was utilized for the postural examination, radiographic examination, and chiropractic treatment (3x week for 3 weeks, 2x week for 4 weeks, 1x week for 10 months). The postural examination revealed: (a) large right head translation, (b) anterior head translation, (c) right lateral flexion of the thoracic cage, and (d) right lateral translation of the pelvis. The radiographic examination showed: (a) lateral cervical: Tz = 24 mm, atlas plane line reduced 30° (measured 0° to horizontal), and a kyphotic cervical curve from C2-C7, (b) AP Cervico-thoracic: left LA = 6°, with a left CD angle = 2.5º at mid neck, and with a UTC angle = 5.5º at T2 area, (c) AP lumbo-pelvic: HB angle at sacral base (tilt) = 6º, LS angle = 4.5º, and LD angle = 4º. After 12th visit, post x-ray examination revealed a 67% reduction in all angles on the AP cervico-thoracic view. His posture drastically improved, he could sit for much longer, he no longer talked with a raspy voice, he no longer had back pain, his mental disposition improved, and he no longer got sick with ear infections.[95]

In 1997, Peet[96] reported on a 3 year old female pediatric case with indigestion and pain, which symptoms started after a fall off her bed onto the floor. The parents brought the child for chiropractic care (CBP technique) 2 days after the fall. Postural examination revealed: (a) left lateral head translation, (b) left head lateral flexion, and (c) left thoracic cage lateral flexion. Radiographic evaluation revealed: (a) decreased atlas plane line to horizontal on the lateral cervical (only 10°), (b) nasium: UA = right 2º, LA = right 4º , and CD = left 7º. The patient received daily visits for one week, 3 times per week for 2 weeks, 1 time per week for 8 weeks, and 2 times per month for 3 months. After the fifth visit, the patient had fewer stomach pains and her appetite returned. After 2 weeks, her stomach pains had ceased. Post examination at the 10th visit, with overall improvement measured in the head region and thoracic to pelvis region.[96]

In 1997, Marko[97] reported on a 10 year old boy with asthma. The boy took medications to control his asthma. Postural examination revealed: (a) significant extension and posterior translation of the pelvis compared to the feet, (b) right lateral flexion of the thoracic cage, (c) right translation of the thoracic cage, (d) anterior translation of the thoracic cage, (e) head flexion, (f) anterior head translation. Radiographic examination revealed: (a) +Tz anterior head translation of 25 mm on the lateral cervical, (b) nasium: LA = left 2º , and CD = left 4º. Chiropracticly, the boy was treated 3 times per week for 3 weeks, 2 times per week for 2 weeks, 1 time per week for 4 weeks, and 2 times per month for 2 months with CBP Technique. At the end of 21 visits, the patient was much improved, had less congestion, less asthma symptoms, and less upset stomachs.

In 1997, Peet[98] reported on an 8 year old female with chronic asthma. Prior to chiropractic care, the child used Beclovent™ and Albyterol™1-3 times daily. These asthma

symptoms appeared after a fall in which the child dislocated her left elbow at 5 years of age. Postural examination revealed: (a) left lateral flexion f the head, (b) right lateral flexion of the thorax, and (c) anterior head translation. Radiographic examination with the nasium projection revealed: (a): UA = right 1º, (b) LA = right 1º, and (c) CD = left 5º. Eleven visits after initiation of CBP Technique care, the child's asthma symptoms ceased. In the next 5 months, she only experienced one allergy induced asthma attack. She has been drug free since that time. Post radiographic evaluation revealed: UA = 0º, LA = ½ º and CD = left 1º.

In 1996, Peet[99] reported on a pediatric case of a 5 year old with reoccurring Otitis Media. In the previous 2 years, the child had reoccurring middle ear infections every 3 to 6 weeks and the child had undergone antibiotic medical care. For the current episode of Otitis Media, the parents opted for chiropractic care (CBP Technique). The child's posture examination revealed (a) anterior head translation, (b) right axial head rotation, (c) right head lateral flexion, (d) left lateral flexion of the thoracic cage. Spinal radiographs were obtained: (a) lateral cervical: +Tz Head translation, (b) reduced atlas plane line to horizontal (10°), (c) nasium: left UA = 1º and right LA = 7º. Post nasium x-rays measured: (a) UA = 0º, and (b) LA = ½ º. After the first adjustment, the effusion stopped. In the following 6 months, the child had only one more ear infection with mild effusion and chiropractic care was used, not antibiotic therapy.

In 1995, Peet[100] reported on a cohort study of 8 pediatric cases with asthma. Peet reported improvement in the asthma in 7 out of these 8 cases utilizing CBP technique. Twelve pediatric patients (ages 4-12 years) self selected from an advertisement for a clinical trial on asthma, while 8 subjects completed the study. All participants had a medical diagnosis of asthma, and were taking at least 2 types of medication: Ventolin, Intol, Preventil, Nasal crom, Benedryl, Beconase, Prednisone, Theophyline, and Cromdyn. Each subject had a posture examination with the MetreCom and a series of CBP x-rays of the cervical and upper thoracic spine. Radiographic displacements from normal were reported in tables. All subjects had anterior head translation ranging from 9mm-30mm. By adding UA, LA, and CD angles on the nasium views from the tables, pre- and post-alignment changes were listed in percentages for all 8 cases (82%, 37%, 89%, 55%, 80%, 27%, 76%, and 44%). Seven parents stated that their child reduced the need for medication. Four parents reported that their child did not now require medication. Additionally, two parents reported that their child no longer needed an inhaler to control their asthma, while only one parent reported no improvement.

In 1994, Peet[101] reported a pediatric case with brachial plexus injury in an infant (12 months old) with Down's syndrome utilizing CBP Technique. The one year old male had suffered a brachial plexus injury at birth. The infant had lack of upper body control, especially arm movement, night time wakefulness lasting several hours, unable to fed himself due to lack of ability to move hand to mouth, and unable to sit up. The mother reported a difficult birth with the child in intensive care after birth. The infant had received previous physical therapy for 11 months. Posture examination revealed (a) right head lateral flexion, (b) right lateral flexion of the thoracic cage. Radiographic examination revealed; (a) lateral cervical: mild atlantoaxial instability, (b) nasium: left UA = 3º, right LA = 3º and left CD = 6º. The patient received chiropractic care for 4 months (3x week for 3 weeks, 1 x week for 3 months, and 2x month in the last month). At the 3rd visit, the parents reported that he was able to lift his arm for the first time in his life to wave and that he could bring a cheerio to his mouth with his hand. Over the following 2 months, the child only had two sleepless nights. After 6 weeks of care, he could sit up and began to crawl. After 3 months, the child's abnormal posture completely resolved.

In 1994, Garde[102] reported on a pediatric case with asthma. He also provided a review of asthma and spinal manipulation. The case was of a 6 year old body who had suffered from asthma since 1 year of age. The boy coughed continuously and had shortness of breath. He was diagnosed by an MD and given Beclovert and Verytolon, which he had to use 3 times or so per day. His posture examination revealed: left head translation, left head rotation, left lateral flexion of the rib cage, both shoulders rounded forward, pelvic tilt (+Rx), and knees extended. Radiographic examination reveal: (a) 35º cervical lordosis of C2-C7, but with 20mm of +Tz head translation, (b) nasium view: 5° UA of atlas to skull, and (c) thoracic views: box like appearance associated with abnormal breathing patterns. CBP Technique was utilized (9 visits in 1st month, 7 visits in 2nd month, 10 visits in 3rd month, 6 visits in 4th month, 4 visits in 5th month, and 4 visits per month for the next 6 months). After chiropractic care, the boy runs, plays sports, rides his horse without needing medication. His mother reports that she cannot remember when he last used his inhaler.

In 1994 Kent[103] reported on two pediatric cases with vertebral body deformities. In case 1, a 10 year old boy with a painful limp was provided a radiology examination. On the lateral lumbo-thoracic view, a marked angulation of L2 on L3 was observed with focal kyphosis and a seemingly dislocation in flexion and anterior translation grade 4. Lateral cervical revealed odontoid dysplasia. In a 16 year old boy, with lower thoracic pain, AP and lateral radiographs were obtained. The lateral thoracic radiograph revealed severe wedging of three segments with increased kyphosis at that region. Kent discussed these deformities as hereditary, developmental and/or from trauma, but could be from infection, neoplasm, or metabolic disease, but radiographs are needed to find and diagnose these conditions.

In 1994, Marko[104] reported on a pediatric case with constipation. A 10 month old female was provided chiropractic care utilizing CBP technique for constipation that started at when solid foods were introduced at 6 months of age. The patient was a Frank Breech position delivery. At one point the baby became impacted and emergency care was necessary. At her first chiropractic visit, the patient could not yet crawl and went a week to ten days between bowl movements. Parent reported that she had a bowel movement only by being in a warm bath and by parental massage of her abdomen, and she would cry and scream during the process. By hanging the baby from her arm pits and observing her lying supine over time, a postural analysis was performed. She had lateral flexion of the pelvis, anterior translation of the thoracic cage, and left lateral flexion of the head. Radiographic angle revealed: (a) HB sacral tilt angle of 7°, (b) nasium view: UA = 1º left, LA = 5º right, and CD angle = 3º right. She was seen 3 times per week in the beginning, but needed more frequency depending upon her posture. After the second visit, the child had a bowel movement by herself. After 2 weeks, the girl had regular bowel movements every 2-3 days by herself without pain. During this time, her muscle tone improved and she began to crawl. At 23 months of age, she began to walk and had totally normal bowel movements each day.

In 1994, Mawhiney and Mawhiney[105] reported on a Down's pediatric case with scoliosis. The patient was a 10 year old boy, who had staggered gait, disturbed speech, poor coordination, and slow papillary response. The boy had been seen by a MD who prescribed a brace for the scoliosis, which was progressing (increase from 42° to 52º thoraco-lumbar curvature and 42° to 47º thoracic curvature). The MD suggested Harrington rod surgery. AP full spine radiographs were obtained standing and hanging. Hanging views revealed a 25% reduction in the T5 apex angle and nearly 50% reduction in the T10 apex angle. Pelvic displacements decrease on the hanging view. Right Logan Basic contact was provided, with a heel lift in the right shoe,

adjustments at the the apexes of the curvatures, and use of Leander traction/distraction with a scoliosis strap. From July 22, 1994- September 2, 1994, the patient was given 17 treatments. Instead of progressing, on post x-ray, the thoracic curve reduced from 45° to 41º. The Post standing AP full spine view revealed better alignment of the odontoid over the sacrum. The patient has a longer attention span, more energy, and more flexibility.

Conclusion

Through the proper use of radiographic imaging the doctor of chiropractic may determine the appropriateness of chiropractic care for the pediatric patient as well as a course of correction of vertebral subluxations. Visual inspection of the spine and related areas by radiographic study provides information that may not be available by other means. The attending chiropractor should decide what is in the best interest in care for the patient. Radiographic evaluation of the infant and child is a privilege and responsibility that the chiropractor is trained to accomplish. This is why Chiropractors have x-ray privileges mandated by State and Provincial Laws in various countries.

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