The chiropractor's role in the treatment of sleep disordered breathing

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ABSTRACT

As sleep problems are a common issue for infants, all professionals work with these children with short- and long-term benefits in mind. The purpose of this clinically oriented article is to acknowledge, investigate and provide a professional commentary on some of the key parameters that should be a priority for chiropractors working with children with sleep disorders.

Key terms: Disordered sleep, chiropractic, infants, children, respiratory cycle.

Introduction

Childhood sleep disordered breathing has become an epidemic problem throughout the world, with 95% of the children with obstructive sleep apnea failing to be diagnosed. "700,000 Aussie kids under 10 have sleep problems which goes up to 1.9 million in the UK, 11 million in the USA and half a billion in Asia."[1] As the quality of children's sleep deteriorates, the rates of childhood obesity, anxiety and behavioral disorders have been on the rise.

Which healthcare specialty is best suited to diagnose and treat childhood sleep disorders? An infant's first healthcare providers may be a midwife, doula, lactation consultant and/or a pediatrician. As they get older, they may be referred to an ear, nose and throat (ENT) specialist, pediatric dentist, speech language pathologist, occupational therapist, oral myofunctional therapist, or a behavior therapist. Another healthcare provider whose care spans children of all ages and has the appropriate training to identify this problem is the pediatric chiropractor. The pediatric chiropractor is in a unique position to not only identify the problem, but to make the appropriate referrals while rendering care to the child in a collaborative relationship to resolve the condition. According to a study by Moore, et al., that although snoring and sleep apnea may be the most common indication of a respiratory sleep disorder in a child, one quarter of children presenting to a sleep clinic for evaluation will have a second sleep diagnosis, which is often non-respiratory in nature. They recommend that clinicians working in this arena must be prepared to recognize, evaluate, and manage sleep disorders across the lifespan of the patient.[2]

Defining the Issue

Sleep disordered breathing is defined as a blockage of all or part of the airway. There is a spectrum of sleep disorders, ranging from open mouth breathing to upper airway resistance syndrome, to snoring and to obstructive sleep apnea. When open mouth breathing is observed in a newborn baby, it is often accompanied by a recessed mandible and possible tongue, lip and/or buccal ties. Snoring can be heard and may be indicative of obstruction. It is the author's opinion that snoring should not be considered normal in an infant (or at any age). Upper airway resistance will sometimes present as noisy breathing. Other types of sleep disordered breathing are respiratory effort-related arousals (RERAs) and parasomnias. RERAs are defined as changes in upper airway pressure which limit the flow of air during each breath in the later sleep stages and rapid eye movement (REM) sleep. Parasomnias include sleepwalking, night terrors, unusual movements, teeth grinding, nightmares and sleep-related eating disorders.

There are many signs and symptoms of sleep disordered breathing, starting with infancy, moving through childhood and into adulthood. Many of these symptoms are either overlooked, or the symptoms are treated but the cause is never addressed. At birth, an inability to latch or breastfeed successfully (meaning transfer sufficient milk to sustain themselves) can be a red flag to assess an infant for sleep disordered breathing. One cause of either or both aforementioned issues could be tethered oral tissue syndrome, aka "tongue-tie."[3,4] Cranial distortions can also cause latching issues.[5] A recessed mandible can be observed in either one of these conditions. The child may also have a heightened gag reflex which would be an intact neurologic mechanism to prevent aspiration of liquids when the integrity of the suck, swallow, breath synchrony is impaired.[6] As the child grows, an open mouth posture and venous pooling under the eyes may be observed, as well as an architecturally narrow face or poor midface development.[7]

Parental description

The parents may report that the child has many bedtime antics to avoid going to sleep. Once asleep, the child may be very restless, awaken through the night, have enuresis,

nightmares, or night terrors. Sometimes they will sleep for long periods of time but never seem well rested.[8] Speech issues with or without tongue thrust (pressing the tongue up against the teeth or between them while swallowing) are very common. These children are often picky eaters and prefer to consume juice or some other type of sugary drink to "keep them going" since they are exhausted. Behaviors can be very challenging with these children.[9]

Sleep disordered breathing in infants can be difficult to diagnose due to the varied signs and symptoms. These babies often do not like to lie on their backs nor their stomachs, preferring to be held. The caregiver will often report that the baby will only lie on their stomach if they are on someone's lap, thus not in a completely flat position. When nursing, they will often pull on or pull off the nipple, fatigue quickly and either fuss or fall asleep, exhausted from their efforts, before transferring an adequate amount of milk to satiate themselves. They may have a narrow gape and/or shallow latch and dribbling while nursing is also common. The mother will often report that she must supplement nursing, and the provider needs to help her discern whether her milk supply is insufficient or whether the infant is unable to transfer milk therefore failing to stimulate her milk supply. The mother may also report that breastfeeding is painful and that the infant cannot open their mouth wide enough to get a deep, secure latch. This baby will often have a difficult time taking a pacifier as they cannot hold onto it, due to a tongue thrust and/or shallow suck.

Sleep disordered breathing can also present itself as noisy breathing or a light snore–a cause for alarm in an infant. Infants with sleep disordered breathing are also often diagnosed with gastroesophageal reflux (GER).[10] These conditions–inadequate milk transfer, a tongue thrust, a shallow latch or weak suckle, and gastroesophageal reflux disease are often accompanied by aerophagia. This is when the baby is taking in air while feeding, whether it be by breast or bottle, which can be correlated with sleep disordered breathing.[11]

Long-term problems

If sleep disordered breathing is not diagnosed and treated in infancy, it may progress to more serious problems as a toddler, school age child or adolescent. This child will often be observed with open mouth breathing while awake or sleeping. This child may wake frequently through the night. One example would be a toddler who is waking frequently (8-10x at night) to breast or bottle feed. While sleeping, these children may have nightmares, night terrors, restlessness, sleepwalking and persistent enuresis (despite demonstrating bladder control while awake). This child can be very hard to put to bed because they are in a constantly elevated sympathetic state ("fight or flight"). While eating, they will often refuse anything other than soft processed foods such as macaroni and cheese, crackers, or processed chicken nuggets. They are often a slow eater, have an aversion to chunky or chewy textures, and may have a heightened gag reflex (in some cases, causing them to vomit their food). They will constantly crave simple carbohydrates which will perpetuate the sympathetic state. They will often have a nasal voice because of swollen adenoids and/or tonsils. They will be prone to colds and allergies, venous pooling under the eyes and a narrow chin. Behavior issues may start to emerge: they will often be emotional and predisposed to outbursts or anger. When they are of school age, they will frequently be diagnosed with attention deficit hyperactivity disorder (ADHD), attention deficit disorder (ADD) or oppositional defiant disorder (ODD), with poor focus, inability to concentrate and distractibility as primary symptoms complicated by defiant and impulsive behaviors.[12] Speech can continue to be an issue.[13]

Respiration cycle

The suck, swallow, breath synchrony evolves in utero, with swallowing beginning at 11 weeks. The organized suck/swallow pattern emerges by 32 weeks in utero. The tongue raised at rest and resting on the palate creates the shape of the palate. The palate is the bottom of the maxillary sinuses and the shape of the palate helps determine the size of the airway. Cranial-sacral therapy as taught by sacro-occipital technique (SOT) provides training on evaluation and treatment.[14] Lips closed and a closed mouth posture function as future braces for the teeth, allowing them to come in naturally. A correct suck/swallow position is lips closed with tongue resting on palate while nasal breathing.[15]

All twelve cranial nerves are involved with breastfeeding, but there are seven of the twelve which are critical for successful breastfeeding. As a baby turns their head towards the nipple, they engage accessory cranial nerve (XI). Facial nerve (VII) and trigeminal nerve (V) are used to open the mouth to latch onto the nipple. Hypoglossal nerve (XII) is needed to push the tongue up on the nipple to stimulate milk production. Finally, the milk needs to be delivered to the back of the throat to swallow and the nerves utilized for this are the glossopharyngeal nerve (IX), vagus nerve (X) and trigeminal nerve (V). Craniocervical dysfunctions can impair the correct processing of the cranial nerves.[16] SOT practitioners with cranial training can be effective for helping to resolve cranial nerve issues. The correct pattern for nursing is suck, swallow, breathe, suck swallow, breathe, over and over.[17]

Bottle feeding can cause many issues that may not show up until the baby is a bit older. When a baby bottle feeds, the milk flows into the mouth more easily. The baby does not need to open their mouth as wide as they would

breastfeeding. The tongue will often thrust forward to control the flow of milk. All of these patterns may lead to cranial-facial developmental changes that they could carry for the rest of their life. Since the tongue does not need to push up on the palate, the same as during breastfeeding, the palate may not widen out and develop as fully as that of a breastfed baby. This can cause the palate to be high and arched which, in turn, potentiates open mouth breathing, crooked teeth and a need for braces. They could also develop a hooked nose, narrow chin and a smaller airway, causing them to be more prone to ear infections, allergies and asthma.[18]

Associated issues

One reason why breastfeeding can be difficult if not impossible is Tethered Oral Tissue Syndrome, aka TOTS or ankyloglossia. TOTS can be an anterior tie, posterior tie, lip or buccal tie. The definition of a tongue tie is restricted mobility as a result of a short lingual frenum, a condition often affecting breastfeeding, but not always. Evaluating for a tongue tie can be easily done during an examination. The doctor places the baby in a supine position. While wearing gloves, the doctor places two fingers under each side of the tongue and lifts it up towards the palate while an assistant (or parent) pulls the chin down. The tongue should be able to lift up to the palate. This is when the doctor will observe the frenulum, checking that it does not pull up the floor of the mouth or blanch too much. Not all frenum need be revised with a frenectomy. It is the author's opinion that performing cranial-sacral work on a baby will often help the baby to nurse, but a minimal to mildly restrictive frenum does not always need a revision, nor would it classify as "ankyloglossia." If a baby ultimately needs a frenectomy, manual therapy ("body work" as it is referred to colloquially) with soft tissue therapies, chiropractic adjusting and cranial-sacral work may be helpful to ready the baby for the procedure to optimize the outcome.[19] Keeping up with manual therapy after the procedure is very important to help the baby integrate the changes that have been made neurologically and reduce their compensatory motor patterns and to further reduce any dural tension as a result of the tethered oral tissues.[20] If this condition is not corrected (with or without surgery), there is a possible cascade of symptomatology that can occur. The infant or child may display open mouth breathing, develop a narrow palate/face, frequent illnesses that can lead to snoring and eventually to obstructive sleep apnea as the tongue slides back in the airway rather than remaining up on the palate.

Nasal breathing is what we are designed to do — but what are the effects of nasal versus mouth breathing? Very simply, nasal breathing warms and humidifies air, filters allergens and microbes, creates nitric oxide, increases our ability to absorb oxygen, regulates blood pressure and keeps us in a calm parasympathetic state. Mouth breathing, on the other hand, results in dry mouth, bad breath, snoring, fatigue, brain fog, dental caries and continues to elicit a sympathetic response. Craniofacial development is also affected. A nasal breather tends to develop a wide face, good cheekbones, alert eyes and a straight nose. A mouth breather is prone to develop a narrow face, crooked teeth, crooked nose, head forward posture, tired eyes, droopy eyes, and venous pooling under the eyes.[21]

Sleep stages

It is important that the chiropractor understand all the stages of sleep and the hormonal implications of getting proper or restorative sleep, versus sleep interrupted by sleep disordered breathing. Sleep is usually divided into non-rapid eye movement (NREM) and rapid eye movement (REM). Adults cycle through four to five times a night with each stage lasting 90-120 minutes. Babies and children cycle through more often with their REM sleep lasting longer depending on the number of hours that they sleep.[22]

NREM has four stages. Stage one involves falling asleep during which the heart rate will slow down but the person is still easily aroused by light and sound. Stage two is the longest phase of sleep. At this point, the muscles will relax and snoring may start. Our brains are at work consolidating all the learning from the day. Stages three and four are the deepest phases of NREM sleep. During these stages, temperature, heart rate and breath rate all decrease, and parasomnias and enuresis can occur. Long-term memory is consolidated, and tissue repair and release of growth hormone take place.[22]

During REM, procedural and spatial memory are created (often referred to as the "dream stage"). Physiologically, the body is paralyzed during this stage, and rate of breath, heart rate and blood pressure all increase, and toxins are removed from the brain while brain activity increases.[22]

Time spent in REM vs NREM sleep changes as a child grows. While a six-month-old baby spends their sleeping time equally split between REM and NREM, a five-year-old will only spend 30% of their time in REM and 70% in NREM sleep. By the later teenage years, only 20% of sleep is spent in REM and 80% in NREM which continues throughout adulthood. One reason for this is that neuronal pathways are laid down during REM sleep and synaptic pruning occurs during NREM sleep. Development of the brain starts in the back of the brain, the primal brain, and moves into the front cerebral cortex as maturity takes place. This is why getting proper sleep is important for critical thinking to develop.[23]

Hormonal activity during these stages is deeply affected by sleep disordered breathing. Secretion of antidiuretic hormone (ADH), atrial natriuretic factor, leptin, ghrelin,

somatotropin, melatonin, and cortisol are all affected. During normal sleep, ADH is released which inhibits urination while in deep sleep. Atrial natriuretic factor, a hormone secreted by the heart to regulate salt-water balance and blood pressure, is inhibited by sleep apnea which in turn inhibits the release of ADH.[24] Also, secretion of leptin, which inhibits hunger, is decreased with sleep disordered breathing, and ghrelin, a hormone stimulating the drive to eat, is increased. Somatotropin (growth hormone) and melatonin are both decreased, while cortisol is increased, with sleep disordered breathing.[25]

Irregularities in breathing during sleep can cause permanent damage to health, including brain damage with an up to 10-point loss in intelligence quotient. Neurocognitive deficits include impaired attention, focus, reasoning, and problem solving. Prolonged sleep issues reduce gray matter in the brain, and low blood oxygen impairs the immune system but also the growth of a child.[26,27]

There is also a strong link between inadequate sleep during childhood, and an increased risk of Alzheimer's disease in adulthood. The glymphatic system in our brain is the lymphatic system for the glial cells, most active during the deepest phases of NREM sleep. The glial cells shrink by 60 per cent during these phases to accommodate space around neurons to allow cerebral spinal fluid to flow more easily and flush out metabolites from the day's neuronal activity. This process during NREM sleep also cleans out amyloid proteins linked to Alzheimer's disease.[28]

Other key parameters: Several environmental factors can affect the quality of a child's sleep. It is best to provide a dark room for maximum production of melatonin. Screen time prior to sleep should be kept to a minimum, and the use of blue light glasses can improve sleep quality and duration. Children's sleep is affected by artificial sweeteners and food dyes, and these chemicals should be eliminated and replaced by whole foods and a minimum of sugars.

Pacifiers should be discouraged by six months of age. Prolonged use of a pacifier can affect formation of the jaw and contribute to open mouth breathing. A good alternative is the Myo Munchee, a medical grade silicone device invented by a dentist in the 1960's and carried on by his daughter, Mary Bourke, chiropractor. It helps train proper suck/swallow, stops thumb sucking, promotes nasal breathing, supports cranial-facial growth and healthy oral hygiene. It can be used with babies as young as six months (Bebe Munchee) and comes in many sizes to accommodate the growing child.[29]

Conclusion

Chiropractors may play a key role in the field of sleep disordered breathing and are often a part of a team to help with nursing issues such as latching, constipation, colic or GERD. The collaborative network often includes neuro-muscular dentists, orthodontists, pediatric dentists, oromyofunctional therapists, speech and language pathologists, occupational therapists, ENT's, behavior specialists, lactation consultants, midwives, doulas, and naturopaths. A chiropractic exam complements most pediatric exams, evaluating for infant reflexes, evaluation of the suck and cranial-sacral assessment to determine the presence of tension in the dural sheath. Chiropractors can also screen for tongue, lip, and buccal ties and can perform pre and post frenectomy work if needed. The treatment may include chiropractic adjusting, cranial sacral work, teaching use of Myo Munchees and educating families about environmental and nutritional correlations for quality sleep. This team approach is often the optimal way forward to assist children in fully functional feeding and sleeping mechanics.

The question always to be explored is, "Where is your tongue?" The goal should be lips sealed, with the tongue on the palate, and nasal breathing.

References:

1. Moore S. Sleep Wrecked Kids. New York: Morgan James Publishing;2020.

2. Moore M, Allison D, Rosen CL. A review of pediatric non-respiratory sleep disorder. *Chest* Oct 2007;130(4):1252-1262.

3. Alan E. Frenotomy may help resolve breastfeeding problems due to tongue-tie. *The Journal of Pediatrics* May 2015;166(5):1320-1323.

4. Tobey AH, Kozar A. Frequency of somatic dysfunction in infants with tongue-tie: a retrospective chart review. *The AAO Journal* 2018;28(4):10-14.

5. Westcott N. The use of cranial osteopathy in the treatment of infants with breastfeeding problems or sucking dysfunction. *The Australian Journal of Holistic Nursing* 2004;11(1):25-32.

6. Coryllos E, Genna CW, Salloum AC. Congenital tongue-tie and its impact on breastfeeding. *American Academy of Pediatrics*, Section on Breastfeeding 2004:1-6.

7. Pacheco MCT, Fiorott BS, Finck NS, Martins De Araujo MT. Craniofacial changes and symptoms of sleep-disordered breathing in healthy children. *Dental Press J Orthodontics* May-June 2015;20(3)80-87.

8. Chervin RD, Hedger K, Dillon JE, Pituch KJ. Pediatric sleep questionnaire (PSQ):validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems. *Sleep Medicine* Feb 2000; Vol 1(1):21-32.

9. Bonuck K, Freeman K, Chervin RD, Xu L. Sleep disordered breathing in a population-based cohort: behavioral outcomes at 4 and 7 years. *Pediatrics*. 2012;129(4):e857-e865.

10. Sinha D, Guilleminault C. Sleep disordered breathing in children. *Indian J Med Res* Feb 2010; Vol 131:311-320.

11. Machedo R, Woodley FW, Skaggs B, DiLorenzo C, Splaingard M, Mousa H. Gastroesophageal reflux causing sleep interruptions in infants. *J Pediatr Gastroenterol Nutr* 2013;56(4):431-5.

12. Rosen CL, Storfer-Isser A, Taylor HG, Kirchner HL, Emancipator JL, Redline S. Increased behavioral morbidity in school-aged children with sleep-disordered breathing. *Pediatrics* Dec 2004;114(6):1640-1648.

13. Mohammed D, Park V, Bogaardt H, Docking K. The impact of obstructive sleep apnea on speech and oral language development: a systematic review. *Sleep Medicine* May 2021;81:144-153.

14. Blum CL.Chiropractic and dentistry in the 21st century. *Cranio* 2004; 22(1):1-3.

15. Campanha SMA, Martinelli R, de Castro L, Palhares DB. Position of lips and tongue in rest in newborns with and without ankyloglossia. *CoDAS* 2021;33(6):1-5.

16. Vallone S. Evaluation and Treatment of Breastfeeding Difficulties Associated with Cervicocranial Dysfunction: A Chiropractic Perspective. *JCCP* 2016 (Dec); 15(3): 1301 -1305.

17. Sakalidis VS, Geddes DT. Suck-swallow-breathe dynamics in breastfed infants. *J Human Lact* May 2016;32(2): 201-211.

18. Radzi Z, Yahya NA. Relationship between breast-feeding and bottle feeding to craniofacial and dental development. *Annals of Dentistry* University of Malaya 2005;12(1):9-17.

19. Ghaheri BA, Cole M, Fausel SC, Mace JC. Breastfeeding improvement following tongue-tie and lip-tie release: a prospective cohort study. *Laryngoscope* May 2017;127(5):1217-1223.

20. Vallone S. Chiropractic evaluation and treatment of musculoskeletal dysfunction in infants demonstrating difficulty breastfeeding. *JCCP* 2004; 6(1):349-368.

21. Sarawata S, Mali L, Sinha A, Nanda SB. Effect of naso-respiratory obstruction with mouth breathing on dentofacial and craniofacial development. *Orthodontic Journal of Nepal* 2018;8(1):22-27.

22. Boyce R, Williams S, Adamantidis A. REM sleep and memory. *Curr Opin Neurobiol* June 2016;44:167-177.

23. Esposito M, Antinolfi L, Gallai B, Parisi L, Roccella M, Marotta R, Lavano SM, Mazzotta G, Precenzano F, Carotenuto M. Executive dysfunction in children affected by obstructive sleep apnea: an observational study. *Neuropsychiatric Disease and Treatment* 2013;9:1087-1094.

24. Capdevila OS, McLaughlin Crabtree V, Kheirandish-Gozal L, Gozal D. Increased morning brain natriuretic peptide levels in children with nocturnal enuresis and sleep-disordered breathing: a community-based study. *Pediatrics* 2008;121(5):e1208-e1214.

25. Saaresranta T, Polo O. Sleep disordered breathing and hormones. *European Respiratory Journal* July 2003;22:161-172.25.

26. Kaemingk KL, Pasvogel AE, Goodwin JL, Mulvaney SA, Martinez F, Enright PL, Rosen G, Morgan WJ, Fregosi RF, Quan SF. Learning in children and sleep disordered breathing: findings of the Tucson children's assessment of sleep apnea (TuCASA) prospective cohort study. *Journal of the International Neuropsychological Society* Feb 2004;9(7):1016-1026.

27. Spooner R, Lushington K, Keage HAD, Blunden S, Kennedy JD, Schembri M, Wabnitz D, Martin JA, Kohler MJ. Cognition, temperament, and cerebral blood flow velocity in toddlers and preschool children with sleep-disordered breathing or behavioral insomnia of childhood. *Sleep Med* May 2016; 21:77-85.

28. Ju Yo-El S, Finn M, Sutphen CL, Herries EM, Jerome GM, Ladenson JH, Crimmons DL, Fagen AM, Holtzman DM. Obstructive sleep apnea decreases central nervous system-derived proteins in the cerebrospinal fluid. *Ann Neurol* July 2016;80(1):154-9.

29. Bourke M, Cole C. Why they suck. The Junction: *Munchee*.