

CHAPTER 9

TODAY CAN MAKE ALL THE DIFFERENCE TOMORROW

If we can treat children early enough, we can potentially prevent problems later in life.

At age five, Sean had his tonsils and adenoids removed to relieve his snoring, asthma, allergies, and frequent illnesses. Initially, that helped a bit, but his symptoms returned over a two-year span, and his mother brought him in to see us. She had become extremely concerned because Sean would stop breathing during sleep, but the surgeon who had removed his tonsils had no further recommendations for treatment. At five years old, Sean was taking many different medica-

tions—for his allergies and ADHD, and some to be able to sleep at night.

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VICTORY

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Inflamed tonsil and adenoid tissue, unfortunately, is somewhat common in children. Now, just because it is common does not make it normal—keep that in mind. That lymphatic tissue is essential

for immunity and is required in pediatric patients as they grow and develop, but if it becomes too hypertrophic (enlarged) and inflamed, it can obstruct the airway and require removal. In fact, removal is a common recommendation without ever understanding what caused the tissue to become inflamed in the first place. There is a reason the tissue becomes inflamed, and it is our job as practitioners to find it. In Sean's case, it was his perpetual mouth breathing, which we noted during his clinical exam.

A comprehensive evaluation of Sean determined that he needed to undergo a diagnostic sleep study. Currently, the American Academy of Pediatrics' Practice Parameters and Clinical Guidelines recommends that all children be screened for snoring during medical visits, and that any child with snoring undergo a diagnostic sleep study. Furthermore, the American Academy of Sleep Medicine recommends that

children complete their sleep study under direct supervision at a sleep center. While home sleep studies are FDA approved for children, it can be hard for them to complete the test successfully without supervision.

We ordered the study for Sean, and the results were astounding. Despite his tonsils and adenoids being removed, he was still suffering from obstructive sleep apnea (OSA). The study showed that he had three episodes an hour and that his breathing would slow to the point of stopping, at which point he would wake up from sleep. Furthermore, during REM, or deep sleep, he was awakened nine times an hour. Again, REM is crucial for cognitive function development, which is extremely important in growing children.

We presented Sean's treatment options to his mom. Since he had already undergone the first line of treatment—having his tonsils and adenoids removed—another option was a CPAP. While CPAP machines are great tools and necessary for children at times, prescribing it would likely condemn him to using it for the rest of his life. Plus, the retractive forces of the CPAP would hinder his facial development—since the mask would attach to his head and pull backward on the face, it would prevent his face from growing and developing forward as nature intended. We try our best to avoid retractive forces on the facial structures of pediatric patients.

The other option for Sean was orthopedic expansion of the maxilla and mandible. By developing his maxilla—which, again, is the bottom of the nose—Sean would be able to breathe better and have greater nasal volume. In fact, the amount of increased

width achieved in the nose would increase the flow of air to the fourth power. By increasing the width of his mandible, there would be more room for his tongue, helping it to rest upward and forward in the palate and prevent it from crowding his airway. These measures to develop his jaw laterally and forward would allow his airway to develop to its full genetic potential. As humans, we have a genotype and a phenotype. Our genotype is our DNA, our biological identity. Our phenotype is the physical expression of our genotype based on the environmental factors we are exposed to. We can alter our phenotype based upon the interactions of our genes and our environment.

The results of the sleep study were good news, because we had an answer to Sean's problems. With his mom's approval, we were able to initiate treatment and begin fabricating his upper and lower expanders right away. We also had the encouragement from the sleep physician to initiate expansion rather than go the CPAP route. We were excited about his treatment because we knew we were going to start transforming his life right then. His treatment today will make all the difference tomorrow.

SLEEP IS ESSENTIAL TO GROWTH AND DEVELOPMENT

Medical literature shows that 10 percent of children are diagnosed with ADHD,³⁸ and that 10 percent are diagnosed

38 "Attention-Deficit / Hyperactivity Disorder (ADHD)," Centers for Disease Control and Prevention, accessed February 20, 2018, <https://www.cdc.gov/ncbddd/adhd/data.html>.

with OSA or sleep breathing disorder (SBD).³⁹ Is it a coincidence that these rates are identical? I do not propose that ADHD does not exist, not by any means, but I do propose that a great deal can go wrong in an individual whose breathing is altered while they are growing and developing. After all, sleep is a crucial time for growth and development. Dr. Darius Loghmanee, a pediatric sleep physician and medical director of six Chicagoland Pediatric Sleep Centers with Advocate Health Care, is a good friend of mine. In a recent lecture to our local community, he advocated for better sleep health. He eloquently explained that the top three symptoms of ADHD are:

- Inattention
- Hyperactivity
- Poor temper

He then went on to describe the top three symptoms of sleepiness in children:

- Inattention
- Hyperactivity
- Poor temper

Again, I'm not proposing that all ADHD symptoms are sleep problems. I am proposing that we better ensure there is

39 James Chan, Jennifer Edman, and Peter Koltai, "Obstructive Sleep Apnea in Children," *American Family Physician* 69, no. 5 (March 1, 2004): 1147–1155, <https://www.aafp.org/afp/2004/0301/p1147.html>

adequate sleep being achieved before initiating pharmaceutical treatment for children with symptoms of ADHD.

Take Sean, for example. In his most crucial stage of sleep, he was waking up nine times an hour. Ask any mother if you can conduct an experiment that involves waking up her child nine times an hour—and feel free to share her response with me. I asked my wife that question and she laughed at me, then issued a few threats—the experiment went no further.

Drs. Kevin L. Boyd and Stephen H. Sheldon wrote a great chapter in a medical textbook explaining the incidence of pediatric sleep-disordered breathing (another term for SDB) and its relationship to facial development. Here are some excerpts from their work:

Pediatric sleep-disordered breathing (SDB) is a pathological condition associated with a wide range of clinical symptoms, historical evidence, dentofacial physical examination findings, environmental components and genetic and/or epigenetic factors. Recently published controlled studies indicate a close association between pediatric SDB/OSA and neurocognitive impairments such as ADD/ADHD and other behavioral disorders. Many of the various physical characteristics associated with a high prevalence of pediatric SDB/OSA are also strongly associated with a number of pediatric dentofacial abnormalities; the relationship between pediatric SDB/OSA and

*the developing jaws and facial structures is also well described.*⁴⁰

Drs. Boyd and Sheldon write that physical features and facial developments can be risk indicators for development of SBD and cognitive dysfunctions in children as they grow and develop.

There are a number of factors that are known about facial development. For starters, dentofacial malocclusion is a risk indicator for OSA—if a patient has a narrow dental arch, crooked teeth, or open-mouth posture, they're at risk for developing OSA.

Also, since the agricultural revolution, craniofacial volume has steadily decreased. With the introduction of industrialized farming, facial and airway volumes have consistently decreased—faces have become smaller and nasal passages have become narrower. That is likely due to the lesser physical challenges posed to the developing palatal suture complex during infancy and early childhood. The palatal suture complex refers to the seams in the cranial bones that run along the roof of the mouth. Addressing development issues with these cranial sutures during childhood can, again, make all the difference tomorrow.

According to Boyd and Sheldon:

With ever accumulating physical evidence from anthropological studies, combined with advances in

40 Kevin L. Boyd and Stephen H. Sheldon, "Childhood Sleep-Disorder Breathing: A Dental Perspective," in *Principles and Practice of Pediatric Sleep Medicine*, Sheldon et al. (Elsevier Saunders: 2014): 273.

*the newly emerging scientific disciplines of epigenetics and evolutionary medicine, it can be stated with a reasonable degree of scientific certainty that malocclusion is not primarily a genetically determined disease entity. Rather, malocclusion is better described as a WD (Western disease) that is primarily mediated through a gene-environment interaction that follows a fairly predictable pattern of pathological progression: initially, most WDs are preventable so long as genetically predisposed individuals are identified before early phenotypic expression of the disease is obvious.*⁴¹

So, Drs. Boyd and Sheldon point to environment, more so than genetics, as being the cause of malformation of the maxilla and mandible, mouth, and teeth. With each generation of narrower faces and maxilla and mandible, the genotype is affected. Again, genotype is DNA, a person's biological identity. Those changes can even affect future generations—that is the study of epigenetics, a phenomenon that really takes an entire book to discuss. The point being: If we identify these problems in children early enough, we can change the disease progression and alter their growth and development, breathing, cognitive function, and ability to thrive. We can minimize the chances that malocclusion and

41 Kevin L. Boyd and Stephen H. Sheldon, "Childhood Sleep-Disorder Breathing: A Dental Perspective," in *Principles and Practice of Pediatric Sleep Medicine*, Sheldon et al. (Elsevier Saunders: 2014): 273.

limited facial growth will contribute to a child's poor sleep and breathing.

If a child grows to develop SBD and poor facial structure, their risk for TMD problems in the future also increases.

IDENTIFYING TMD AND OSA

In my practice, I often see adults who bring their children with them to appointments. Over the years, I began to see how those children would grow and develop if no intervention was done. So, I started treating kids basically out of necessity—I was treating parents whose children were beginning to suffer the same problems as the parents had in childhood, and those parents wanted the problems intervened at an earlier age.

Let's look at some of the common symptoms we see in pediatric patients dealing with TMD and/or sleep apnea. These include:

TMD AND/OR SLEEP APNEA SYMPTOMS IN CHILDREN

- headaches and migraines
- jaw and face pain
- bedwetting
- mouth breathing
- recurring ear infections
- impaired intelligence

- decreased performance/learning problems in school
- hyperactivity
- aggressiveness
- social isolation, withdrawal
- night terrors
- night sweats
- mood changes
- poor concentration

Headaches and migraines. Children diagnosed with migraines are 8.25 times more likely to have SBD. Whereas children diagnosed with chronic, tension-type headaches are 15.23 times more likely to have SBD.⁴² If a child presents with headaches, facial pain, and ADHD-like symptoms, it's crucial to have a proper sleep evaluation and determine whether a diagnostic sleep study is an appropriate next step.

TMD pain and jaw joint noises. Dr. Olmos reported that one in six children and adolescents has clinical signs of TMD. Over 23 percent of preschool age children have pain when chewing and TM joint noises, and all that TM joint noise is pathologic. And in the United States and around the world, the prevalence of OSA is increasing. A total of 26 percent

42 Steven Olmos, "Pediatric severe apnea/obesity/TMD/headache — Class III," *Orthodontic Practice*, case study, vol. 7, no. 3.

of the American population is at high risk for OSA, and 57 percent of those are at high risk for OSA.⁴³ Thus, the earlier we can screen and treat these problems, the better chance we have of preventing them in adults.

Bed-wetting (nocturnal enuresis) is a hallmark indicator of OSA in children, because sleep problems can disrupt the hormones that regulate the urge to urinate. Once a child is past the age of potty training, ongoing bed-wetting needs to be addressed with a formal sleep evaluation to determine whether OSA is present.

Mouth breathing is another key indicator. It is normal to breathe through the nose, not through the mouth. Mouth breathing in children leads to a cascade of negative events, including less oxygen to the lungs, altered facial development, and episodes of hyperventilation (over-breathing) throughout the day. These cascades of events originating from mouth breathing causes us to get approximately 20 percent less oxygen to our tissue.

Pediatric patients with chronic mouth breathing also tend to have more upper respiratory congestion, and one of the common signs and symptoms of upper respiratory congestion is recurrent ear infections and buildup of inflammation inside the ear. Because they're mouth breathing

43 Steven Olmos, "Comorbidities of Chronic Facial Pain and Obstructive Sleep Apnea," *Current Opinion in Pulmonary Medicine* 22, no. 6 (November 2016): 570-5.

and not warming, moistening, and filtering the air they breathe, patients can get recurrent ear infections that require treatment. While it's crucial to treat the ear infections, it's even more important to determine the cause, which is often found to be mouth breathing. An article in the *American Journal of Orthodontics and Dentofacial Orthopedics* discusses the importance of identifying mouth breathing since it causes malocclusion, and yet many orthodontists struggle to accurately identify a problem with mouth breathing.⁴⁴ We need better education on this subject, and it's great to see the specialists recognizing this need.

Lower IQ and behavioral issues. A study conducted in Europe looking at thousands of children found that those who snore actually have a lower IQ as a result of the sleep deprivation, which disrupts their memory consolidation and ability to learn. Memory consolidation is the brain's retaining and filing of all the facts and activities encountered throughout the day for access in the future. That occurs during the deeper stages of sleep.

The quality of sleep plays a crucial role in a child's ability to focus throughout the day. Often, adults point to behavioral issues in children, even to the point of identifying their problems as ADHD. However, often it's just that the child is lacking proper sleep, as Dr. Loghmanee often discusses.

44 Julia Garcia Costa, et al., "Clinical recognition of mouth breathers by orthodontists: A preliminary study," *American Journal of Orthodontics and Dentofacial Orthopedics*, vol. 152, issue 5 (November 2017): _ Vol 152 _ Issue 5: 646–653.

The “scorecard” for pediatric sleep apnea is an apnea hypopnea index (AHI) of:

- 1-5 = mild
- 5-10 = moderate
- >10 = severe

What’s great about identifying these problems at a young age is that they’re very treatable and can really change the landscape of the patient’s life moving forward. Most parents would do anything for their children that will benefit them indefinitely. Treating TMD and OSA begins with understanding the situation, getting the right diagnosis, and then coming up with a clear-cut treatment plan for the child. Remember: diagnosis is 95 percent of effective treatment.

SEAN’S VICTORY

Sean was suffering from many of the aforementioned symptoms. While he was a very pleasant young boy, in his earliest visits he did not sit still in the chair. He would try to hang from the dental light, pretending it was a spaceship. It was tough to get him to cooperate, but nonetheless, we at least understood the reason for this behavior after we got the results of his sleep test.

Sean needed a greater ability to breathe through his nose and adequate room for his tongue. By expanding his maxilla, we increased his nasal volume, which also allowed his tongue to rest high in his palate. That helped push his

maxilla forward, opening his airway from both a lateral (side-to-side) and an anterior-posterior (front-to-back) dimension. We were also able to help facilitate forward growth of his mandible, which allowed more space for his tongue and further improved his airway volume. This was all quantifiable through CBCT technology and close observation as we monitored his progress.

Throughout treatment, we also discussed dietary and other changes with his mom that could help Sean progress further.

We delivered his upper and lower expanders in February and started activating his appliances to initiate his orthopedic development. In his monthly follow-up visits, his mom began reporting improvements: his snoring was beginning to resolve, his behavior at school was getting better, and his agitation improved immensely.

In fact, in June, Sean showed us how much his grades and school performance had improved by sharing with us his report card—straight A's!

Come September, expansion was complete, and we were ready to do a follow-up validation sleep study to confirm that we had controlled his apneic events and had established proper nasal breathing and improved facial development. The results of his validation sleep study were nothing short of amazing. During that night of sleep, he only had one event in which his breathing slowed enough to wake him up. His oxygen levels maintained at a healthy level throughout the

night, his AHI was within normal limits, and his OSA was satisfactorily resolved.

At the end of treatment, Sean was doing very well: His cognitive function, behavior, and sleep had improved dramatically. When he came for a visit, he sat still in the chair and was a very well-behaved patient. The changes that we saw in him were simply astounding—his problems had all been caused by his inability to breathe adequately while he was sleeping at night. Thankfully, he was able to discontinue the use of his medications, since we had found and treated the source of his problems.

Moving forward, we must ensure that proper facial development continues. To do that, we'll maintain Sean's nasal patency (the openness of his nose), helping him to continue breathing adequately through his nose so that he grows and develops to his full genetic potential. We will continue to monitor Sean yearly and coordinate with his orthodontist on how to proceed with his orthodontic treatment in the future, if it is needed. Our goal is to avoid having his apnea return, and we can do our best to ensure this by monitoring his facial development, inquiring about his sleep, and watching his social behavior and how he's performing in school.

Often, with pediatric patients, I'm asked by patients and other providers how we know we've done enough. Dr. Christian Guilleminault eloquently states: "Elimination of oral breathing, i.e., restoration of nasal breathing during wake and sleep, may be the only valid end point when treating OSA. Preventive measures in at-risk groups, such

as premature infants, and usage of myofunctional therapy as part of the treatment of OSA are proposed to be important approaches to treat appropriately SBD and its multiple comorbidities.”⁴⁵ It is this thought process that needs to be taught to all providers of pediatric patients, because Dr. Guilleminault’s research shows that 75 percent of children treated with tonsil and adenoidectomy relapse after four years.⁴⁶ That is exactly what happened to Sean.

So the utopia for children is to achieve proper functional nasal breathing where the tongue is in the ideal position, resting high in the palate, to ensure that they have proper facial development moving forward.

In the next chapter, I’ll discuss some of the treatment modalities, team members, and features of the TMJ & Sleep Therapy Centre of Northern Indiana that elevate us and make us a unique resource for many patients.

45 Christian Guilleminault and Shannon S. Sullivan, “Towards Restoration of Continuous Nasal Breathing as an Alternate Treatment Goal in Pediatric Obstructive Sleep Apnea,” *Enliven Archive* 1, no. 1 (2014): 1–5.

46 *Ibid.*