

**Christian Guilleminault, MD, a Founding Father of Sleep Medicine**  
**Video Interview with Dr. Mike Milligan on 10-1-16**

There is so much important information in this 45 minute video that Dr. Mike Milligan made an outline of notes to help you follow the interview. It may be helpful to download and print these notes to read, or use split screen as you watch the interview.

- Hi, I'm Dr. Mike Milligan. I'm here with Dr. Christian Guilleminault, MD, a Founding Father of Sleep Medicine. He opened the first sleep lab back in Paris in 1970. The volume of research papers that he has is world renowned. He is now a Professor of Psychiatry and Behavioral Sciences at Stanford Center for Sleep Sciences in the Division of Sleep Medicine.
- Dr Guilleminault states the prevalence of sleep disordered breathing (SDB) is very high - 60-70% of people complain about their sleep, but this doesn't mean they have a sleep disorder. Very often in the current nomenclature what they ask is that you complain about your sleep on a regular basis for at least the last 3 months, and that the complaint about your sleep has an impact on your daytime well-being. Some problems with sleep disordered breathing are snoring, etc.
- Historically, the medical studies started in the 1960's on very big fat men, called Pickwickian Syndrome, and the first recording of abnormal breathing during sleep on these Pickwickian patients was done in Germany by someone called Ghirardi(?) in 1960 exactly. And for about ten years everybody focused on obesity and Pickwickian Syndrome. Then progressively, and personally I was very much involved in that venture, it came out that people who were non - obese also had abnormal breathing.
- Questions: 1) When does abnormal breathing begin? 2) What leads to this abnormal breathing?
- 2 very different problems:
  - Obese person - puts fat everywhere, and men more in their neck and tongue, so decreases size of airway. Also put fat in abdomen, and you are going to have a combined problem of not breathing well because of the fat in the abdomen, particularly during sleep because you have a restrictive chest bellow disease, and you are going to have a problem in the upper airway. So that's one type.
  - For many many years, people have associated sleep disordered breathing with big fat men. Actually, it's not. So non-obese people also have sleep disordered breathing.
- What leads to sleep disordered breathing - does it suddenly appear in adults, or are there problems you can recognize very early on
  - When you sleep, your airway, a collapsible tube surrounded by muscles, has greater risk to collapse because during sleep the reflexes and muscle tone relax; also you sleep supine, not standing up. So you have two factors which are going to play: 1) the position, and 2) the fact that your control of your muscle is different during sleep and the reflexes are different, and the muscle tone is different.
- Risk factors can be present very early during life
  - Genetic? - 1990's there were large studies on Obstructive Sleep Apnea, which was a syndrome, and what came out was that families have a tendency to have several members with obstructive sleep apnea - so you might suspect a genetic cause. Initially Dr. Susan Redline was one of the people who did a lot of the genetic studies, and found that yes, it runs in families, but there is not a single gene that can explain sleep disordered breathing
  - Environmental?

- The goal is to understand what risk factors early on can predict that sleep disordered breathing will occur. Probably there is a combination of genetic and environmental factors
- Study done by orthodontists interested in understanding growth and crowding in oral cavity - study done in Rhesus monkeys (Harvold, Vargervik, Tomer...)
  - Studies done later in the growth of the face in human children (Sweden, McNamara in U.S., Moss...) confirm the results of the study done in monkeys
  - Fast growth of face occurs in children up until age 6, then a latent period, then fast growth again during puberty
  - Rhesus monkey study at UCSF - if you impair nasal breathing by putting a small ligature in the nose of the newborn Rhesus monkey - this causes a lot of changes in growth of the face. Abnormal nasal resistance led to a change in firing of the muscles of the tongue and upper airway; this has an impact on the growth of the bone; during growth there is always an interaction between the bone and muscle
- In the human face, two growth centers of particular importance are the inter-maxillary growth center (synchondrosis), and the alveolar-dental ligament (periodontal ligament). These are active until about age 15. Stimulation of these growth centers is very important for the development of the face after birth.
  - One study done to verify that what happened in the Rhesus monkey study also happens in children and humans. This study looks at abnormal muscle tone due to a genetic problem causing muscle dystrophy - it showed altered growth of facial structure and upper airway as a result of the altered muscle function.
  - Second study - abnormal muscle tone due to premature birth, particularly younger than 36 weeks gestational age - they had abnormal muscle tone resulting in abnormal oral-facial growth. So these two studies showed premature birth led to infants with abnormal muscle tone leading to abnormal facial growth and this resulted in sleep disordered breathing.
  - Third - so the idea was maybe these growth centers were involved, so next look at abnormality of the growth centers, and these are usually due to genetic connective tissue disorders (Marfan, Ehlers-Danlos Syndrome) - you cannot make inter-maxillary region work properly and you have development of sleep disordered breathing (SDB).
  - Fourth - looking at the alveolar-dental region which is another growth center - there is a genetic disorder leading to absence of teeth, which is called "oligodontia," and again you have abnormal oral-facial growth and narrow airway.
  - So the above several demonstrations showed stimulation of these growth centers is important for the development of the face.
- Next step - is to show what in a normal child leads to the growth. It is the interaction between the muscle and the bone, and through this specific region. It is essentially the tongue muscle, which is the strongest muscle in our body; it is the largest muscle for its space.
- Next question is from birth on what can impact the activity of the tongue muscle
  - Short lingual frenum (tongue tie, ankyloglossia). It is fibrous tissue like a ligament. It may be short and poorly placed.
    - It is best to resect this at birth, because at birth you can just clip it to correct it. If you clip it later than at birth it will re-constitute itself and you will still have a short lingual frenulum for the rest of your life, unless you do other things (e.g., myofunctional therapy exercises for several weeks before and after the clipping of the lingual frenulum).
    - Tongue tie is very common - in a study done on children who came to his clinic, nearly 48% of 150 children had a short lingual frenulum.

- With a short lingual frenulum the tongue cannot get up to the palate properly where it is supposed to always be (except during speech and eating), and stimulate the inter-maxillary growth factor and region, so the palate does not expand and develop properly.
  - Other problems with tongue tie include child cannot breast feed, and also may have difficulty chewing, swallowing properly, and with speech. Often a child is sent to speech therapy, and no one looks under the tongue for a short lingual frenulum.
  - And no one has looked at the relationship with sleep apnea, so we did that recently and it is a big factor.
- Sucking, proper swallowing, and chewing. What are the basic functions for an infant very early on:
  - Sucking - to feed using a breast or a bottle.
  - It is much harder (more work) for the baby to breast feed than to feed from a bottle with a regular nipple. So after the child uses a baby bottle they no longer want to breast feed because it is harder work. But this hard work is important because the baby develops muscle tone through the exercise.
  - If the baby eats soft baby food (e.g., Gerber jars), they don't chew, so they do not develop the muscle tone necessary for proper facial growth. It is important at 6 months they eat things like raw carrots and apples - the baby must chew in the back and on both sides, to develop muscle and make the face grow.
  - The growth of the face is very critical, and is related to the functions of sucking, proper swallowing, chewing, and also nasal breathing.
- Nasal breathing
  - People who are doing pediatric obstructive sleep apnea research always mention you have to take out the tonsils and adenoids (T&A) because they are responsible for your obstructive sleep apnea. But Dr. Guilleminault says yes and no. Yes, people think they are responsible because they do take up a lot of space in the airway - and that it true but it is not the only problem with tonsils and adenoids. A big factor is that they block your nasal breathing and lead to mouth breathing.
  - Mouth breathing means airway resistance. If you run, if you are a trained athlete you carry on breathing through your nose for a long time; but if you don't train you open your mouth very quickly (to breathe). So there is a relation between the effort you can do, and if you are mouth breathing you are not using at all the upper part of your airway. This leads to disuse, and you lose the function. In young children that loss occurs fairly quickly. When you breathe through your nose there are at least ten mechanoreceptors that tell us the speed of the flow, the temperature, the turbulence, etc. All this information is sent to the brain stem, and then you get adjustment of the fibers of all the muscles of the upper airway. If you mouth breath you do not get any of this information, and there is no adjustment.
  - So often only half the job is done. Only the enlarged T&A are looked at. We don't look if these have been existing for some time. The mean age of tonsillectomy in the U.S. is 7 ½ years of age. The enlarged T&A may have been present since age 2, so you may have 5 years where the child has not breathed through his nose. So to take out the T&A it is only half the treatment. You must

also re-train the person to breathe through their nose. Humans are obligatory nose breathers.

- THE END TREATMENT OF ANY SLEEP DISORDERED BREATHING IS NASAL BREATHING. This was published by Dr. Guilleminault and his colleague, Dr Shannon Sullivan. THIS IS BOTH DAYTIME AND NIGHTTIME DURING SLEEP. THIS IS ABSOLUTELY NECESSARY! You must check this during sleep. If you don't obtain that during sleep, you have not succeeded in treating your child.
- You must do the re-education. In the nose you must have sensory receptors activated. Specialists do that. You do irrigation of the nose, nasal breathing exercises, re-educate the muscles. So the nasal re-education and the muscle tone re-education are very critical for any treatment at any age.
- Myofunctional Therapy is the muscle tone re-education.
- Myofunctional Therapy - someone in the 1930's gave it the name Myofunctional Therapy
  - Nasal Breathing. In Europe, an orthodontist, sysetmotologist (medical school), named Delaire, realized there was a lot of mouth breathing and he created the first organized center. Just like orthopedic surgeons know if you do surgery you need to follow it with re-educating the muscle because they get atrophic.
  - Tongue. Similarly, the tongue is a muscle, and you need to re-educate it. Also we try to emphasize the normal function. For example you are going to teach the child to chew in the back molars on both sides, and to swallow the proper way, and ensure the speech is correct. Many children don't even know where their tongue is and cannot do simple movements of the tongue on demand (cigar tongue, etc). This was very well-described in the 1960's, so this is not new, but it has never been applied to sleep disordered breathing.
  - MUSCLE RE-EDUCATION is very important, even in adult with severe sleep apnea. We did a lot of pediatric cases in Brazil, and in Australia a study was done in adults - you CAN CUT IN HALF THE measure that we use to define the severity of sleep disordered breathing which is called the APNEA-HYPOPNEA INDEX (AHI). Dr. Guimaraes and her colleagues showed that within 3 months of daily re-education of this muscle you can really reduce that index.
  - TREAT EARLY. But the goal is to avoid having adults with a lot of changes and complication and abnormal breathing, so we have to start when it develops - START YOUNG. When you recognize the abnormality treat it. Treat it as early as possible to prevent.
  - Posture. When you do the re-education, you not only teach the child to breathe through the nose, to slow down (possibly Buteyko Breathing Re-education), but also it goes to the posture. If you breathe poorly, you are going to have your neck going forward (forward head posture), because this opens the upper airway. You have to teach the child to have a normal posture. It's a whole body re-education because breathing has a big impact on everything else.
- Expansion of the arches. Question: if the child didn't keep their tongue to the roof of their mouth and expand their arch that way while it was pliable, is it then important to expand their arches so they have normal structure as well as re-educating the function? Answer: if you don't have normal function, you don't grow the bone, and you have a very narrow and high hard palate, which is a sign that you have a problem, and it is related to the abnormal position of the tongue, because the tongue should be high and should act on the inter-maxillary cartilage, and that is what makes your face grow. So yes, we can take over what had not happened before,

and that is where we do the expansion, and the expanders work very well for the maxilla. The problem is that we don't have a cartilage on the mandible. We have the condyle, and we can re-position the teeth by making them straighter (and upright lingually inclined lower teeth) which gives a little more space. When you expand the upper arch you give more room for the lower jaw to have a clockwise rotation, which is very important because then the lower jaw can move forward and then you have more room for the airway (oropharynx). But it is sometimes difficult if you have a significant retro-position of the mandible. We can expand very well, we can try to do bimaxillary expansion - we gain very well on the maxilla, but not very much on the mandible. We also do all the re-education. But there are some children where we arrive too late and we are not going to gain enough, so these are the children who will need a surgical approach.

- The surgical approach is not necessarily an orthognathic surgery - it is different - it is for the airway. It is a new field of research. We can try to do surgically-assisted rapid maxillary expansion after 15 years of age. We can also do section in the middle and put an expander to do upper and lower expansion. We usually - at least my philosophy - is that we always wait until the child has finished growth before we cut, because we learned that once you cut, it's much harder to have an impact on the growth of the child. So expand as much as you can before you have to cut. And we usually don't cut before 16 years of age.
- We do an assessment. Sleep disordered breathing can be very detrimental to learning, cognition, and memory in young people age 16 and under. In young people the primary concern with sleep disordered breathing is the brain. And it's the pre-frontal lobe, and it's cognition, attention, hyperactivity, ADHD, etc. You have to see how important it is for school and learning, so sometimes we must use a CPAP to take care of an acute learning problem. And we try to use the masks which are purely nasal, and maybe pillows, and the ones that push the least on the face, because a CPAP can alter the face as well and that has been well-demonstrated. We know that one year of wear of a facial CPAP mask already has an impact on the lower jaw, and this creates a worse airway and can become a viscous cycle. But we have to do this sometimes. We always look at is there a short lingual frenulum, are they congenitally missing teeth which is a problem, we look at all these things and we then try to address the problem.
- We are going to systematically do muscle re-education and nasal re-education, but we may have to do more. And that is where the question of surgical intervention comes up, and which surgical intervention. When you have a child who has had the problem untreated since very early in life, you may have a much harder problem with only re-education to get back to normal, and you will go much faster with some surgical act. So there is a decision made of how bad is the problem, and then you decide what type of surgical approach you are going to use. And you will always use muscle re-education when you do surgery - ALWAYS. And you have to tell the individual that the muscle re-education is a daily work, and for a minimum of 6 months.
- Orthodontics - Question: what about orthodontics where they take teeth out? Answer: we are very very against that. I mentioned that oligodontia, which means you are lacking the permanent teeth, is a big problem because you have a bone retraction. So if you pull out permanent teeth you are going to have a problem, and the earlier you pull the permanent teeth, you are going to have more and more problem. And one of the issues is why do you pull these teeth - usually it is because you have a small oral cavity, and the orthodontist says I want to give you a nice smile, and what they do is they pull the teeth, there is a gap, so they put the headgear, which is going to push the upper teeth backward, and try to align them with the lower teeth - which is completely irrational because you make the oral cavity and support of that collapsible tube (airway) smaller, so you should avoid these things as much as you can. And you can perfectly use an expander, and now we can even do surgical-assisted expansion, so there is no excuse to pull teeth, which will have a very negative impact on your upper airway.

- Mandibular advancement dental devices for sleep apnea - dental devices have been recommended for adults, and they are dental devices, which means they are going to have an impact on your teeth. And that in fact is always going to be detrimental, because you are going to move the teeth in the direction in which you apply forces. That's what you do with braces, and orthodontists know that very well.
  - One of the first problems of the dental device is we want to move the bone and we use the teeth as the way to move the bone. And that's not very good, because we are going to move the teeth, but we are not going to move the bone that much. We move the bone much more with muscle re-education because of the interaction of muscle and bone.
  - The second thing we see is most of the dental devices anchor on the upper teeth and protrude the lower teeth. You have had improvement with the monoblock, with now the Biobloc, and different types, but when you look at the long term effect - and it varies depending on the individual - some may have a bite problem within 2 or 3 years, some will have a bite problem within 7 to 8 years, but in the end you are always going to have a bite problem, because you act on the teeth. So the rationale is the following - we have an adult, they have sleep apnea, they don't want to use CPAP, and they have risk of other complications, co-morbidities, so to have an abnormal bite may be a cheap price to avoid the complications, the co-morbidities. Well, we have to really think about that - is there anything else - did we try to do the muscle re-education? And in our community, I would say one in 100 orthodontists think about muscle re-education. And they all will think about dental device, because that is the publicity. Publicity is not necessarily what should lead medical treatment.
  - Question: Is there an indication when you would use a mandibular advancement dental appliance for sleep apnea? Answer: It's again an issue of what are the risk of co-morbidities, and on top of that the older the patient, the greater the risk will be on your teeth. If you start using a dental device at age 65, the gums may not be in great shape and you may lose the teeth. So usually the recommendation is currently not to have too severe of a patient, and middle age. But you have to realize that you must tell the patient that at one point if they do nothing else, they are not going to be able to use their dental device, because their bite is going to change too much.

Is there anything else you would like to say before we close?

I would say there are always a lot of new approaches which publicize, including for children, including right now the big thing is the Biobloc and does that work. There have been all these appliances which were used in Germany, for example, to make the jaw grow, and we demonstrated that no, they had normal growth, and they didn't grow just because they had that appliance. So I believe that before we say this is really a good new approach we have to demonstrate with real information, with double blind study, and following sufficiently long the children to know the pro and the con, and too often this is not done. So there are too often testimonials - 'I put in that appliance, and the children and the family came back and said that it was wonderful' - that is not a scientific demonstration. We need to have the information - how much do we have, how long does it last, what are the complications, how long we followed, all these things, and that is too often not done.

Dr. Guilleminault, thank you so much for being with us.

You are very welcome.