



Sleep Related Breathing Disorders During Pregnancy

The Impact of Intervention on Maternal and Fetal Health Outcomes

Educational Aims

This self-instructional course for dentists aims to show sleep related breathing disorders during pregnancy increase the risk of adverse maternal and fetal outcomes. Each of these conditions are independently associated with inflammation, oxidative stress from hypoxia, and increased sympathetic nervous system activity. When they occur together however, the health consequences are even more severe. The adverse maternal outcomes include: hypertension, preeclampsia, diabetes, thromboembolism, and cardiomyopathies. The adverse fetal outcomes include: preterm birth, low birth weight, changes in developing palate morphology, as well as growth restrictions that potentially lead to airway deficiencies in the neonate and into adolescence. As SRBD in pregnancy is under diagnosed, there is an opportunity to improve the health outcomes of mother and fetus through screening, diagnosis and treatment.

Expected Outcomes

Dental Sleep Practice subscribers can answer the CE questions online at <https://dentalsleeppractice.com/continuing-education/> to earn 2 hours of CE from reading the article. Upon completion of this course, participants will be able to:

1. Understand the pathophysiologic crossovers of pregnancy and SRBD.
2. Learn the impact of maternal SRBD during pregnancy on the developing fetus and how it may increase the risk of development of SRBD in the neonate and developing child, even into adulthood.
3. Appreciate the importance of screening and treatment to reduce the risk of adverse maternal and fetal outcomes.

by Steve Lamberg DDS, DABDSM

Ample evidence exists showing Sleep Related Breathing Disorders or SRBD, have a negative impact on maternal and fetal outcomes. A growing body of evidence reveals therapeutic intervention directed at SRBD creates positive health outcomes.

SRBD cover a spectrum of medical conditions ranging from Upper Airway Resistance Syndrome "UARS" through severe Obstructive Sleep Apnea "OSA" and are frequently accompanied by the symptom of snoring. The prevalence of OSA ranges from 7.8 to 77.2% in adults aged 30-69 years.¹ Among obese pregnant women, 15%–20% have OSA and this prevalence increases along with body mass index and in the presence of other comorbidities.² These prevalence statistics in women are considered to be significantly underestimated due to gender-related differences in diagnosis resulting from women underreporting symptoms as well as an increased prevalence of UARS that does not meet the criteria to be OSA. Airway re-

sistance even without a cortical arousal can upregulate the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis causing a rise in blood pressure.³

A diagnosis of OSA as well as its key symptom of habitual snoring have been linked to hypertensive disorders of pregnancy, insulin resistance,⁴ gestational diabetes, and poor fetal outcomes. Habitual snoring means at least 3 nights/week and pregnant women who are habitual snorers have a 2-fold greater risk of gestational hypertension relative to non-snorers, although it has also been shown that snoring onset during pregnancy has worse outcomes than if habitual snoring existed pre-pregnancy.^{5,6}

During pregnancy as in menopause, women have an increased risk of SRBD attributable to changes in estrogen and progesterone as well as weight gain.^{7,8,9}

Estrogen contributes to edema, vasodilation, and nasal congestion that could impact the upper airway by making it more collapsible while progesterone enhances respiratory drive creating a “vacuum effect” and could contribute to airway collapse.² SRBD during pregnancy increase the risk of hypertensive disorders of pregnancy “HDP,” occurring in 1 of 10 pregnancies, and are associated with significant maternal morbidity and mortality.^{10,11}

The study, employing the United States Healthcare Cost and Utilization Project-National Inpatient Sample, examined 7,907,139 deliveries and found women diagnosed with OSA were at higher risk of having pregnancies with preeclampsia [odds ratio (OR) 2.2], eclampsia (OR 4.1), chorioamnionitis (OR 1.4), postpartum hemorrhage (OR 1.4), venous thromboembolisms (OR 2.7), and delivery by caesarean section (OR 2.1). Gestational diabetes as well as cardiovascular and respiratory complications were also more

common among these women, as was maternal death, OR 4.2.¹²

Newborns of OSA mothers were at elevated risk of being premature, OR 1.3 and having congenital abnormalities, OR 2.3.¹² The higher risk of congenital anomalies and resuscitation at birth in neonates of mothers with OSA, emphasizes the importance of identifying OSA in pregnant women and women of reproductive age.¹³

Fetal growth restriction was also more prevalent and is the basis of the Sleep Apnea and Fetal Growth Restriction study (SAFER). Fetal growth restriction “FGR,” affecting 10% of all pregnancies, is a major contributor to fetal and neonatal morbidity and mortality with intrauterine, neonatal and lifelong complications. While previous studies have reported an association between low birthweight and elevated blood pressure (BP) in adulthood, the recent Raine study¹⁴ explored the association between intrauterine fetal growth restriction from 1440 women and BP of their adult offspring. Their data revealed evidence that restricted fetal growth was associated with significantly higher adult BP over two decades later that corresponded with a 10% higher risk of death due to heart disease and a 10% higher risk of stroke. This study further reinforces the importance of the early intrauterine environment and its influence on adult BP. OSA has been hypothesized to be a modifiable risk factor for FGR.^{15,16}

Premature birth is one that occurs before 37 weeks of gestation or having a low birth weight. The short-term and long-term effects of preterm birth “PTB” on a child’s physical and psychological growth and development have been a hot topic of interest. The brain, lungs, and eyes are the most susceptible organs, but facial bones and palate morphology

A diagnosis of SRBD has been linked to poor fetal outcomes.



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may also be affected. The prevalence of PTB ranges from 0-10% in children, and 10-70% in children with low birth weight. Palates of premature infants have narrower and deeper forms compared to the palates of non-premature infants. Additionally the mandibular arches are less developed and evidence shows that the lower the gestational age, the more the tooth development is delayed at age 9.¹⁷ Due to this, there is a greater risk of future malocclusion, difficulties in chewing or speaking, and aesthetic problems.¹⁸ Malocclusion traits including crossbite, open bite, midline shift, open bite, spacing, and Angle's Class 2, occurred significantly more often in early pre-term EPT (83.3%) and very pre-term VPT (73%) children, compared with full-term (51.2%) children. Deep bite was the most common malocclusion trait in the EPT and the VPT group. Higher orthodontic treatment need was found for the preterm children.¹⁹ Inadequate growth and development of the jaws compromises the airway and leads to compensations, which have consequences including orthodontic problems.

A normal physiological component of healthy pregnancy is fetal movement, which has been used both formally and informally as a marker of fetal well-being. Reductions in fetal movement accompanies complications such as fetal growth restriction. It has been hypothesized that SRBD may link pre-

eclampsia with reduced fetal movement and that treatment of sleep disordered breathing might improve fetal activity during sleep. A study by Blyton showed CPAP to be effective in improving fetal movements which suggests a pathogenic role for SRBD in reduced fetal activity and possibly other poor fetal outcomes associated with preeclampsia.²⁰

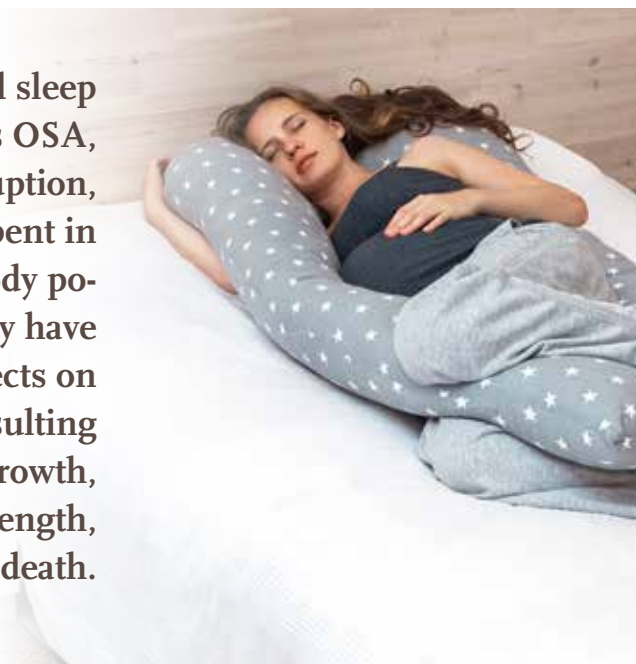
Fetal hiccups were reduced in women with preeclampsia and through intervention with CPAP were found to increase, providing intriguing evidence of the pathogenic connection of airway and fetal health.²¹ Fetal hiccups may be a manifestation of programmed isometric inspiratory muscle exercise in preparation for postnatal respiratory function.²²

A scoping review of the literature with meta-analysis shows that maternal sleep events such as OSA, sleep disruption, and time spent in certain body positions, may have negative effects on the fetus, resulting in altered growth, gestational length, and even death.²³ As SRBD are a prevalent risk factor of gestational cardiometabolic disease, they are a potential therapeutic target to reduce cardiometabolic morbidity.²⁴

Robust literature demonstrates SRBD as a consistent, strong, and positive predictor of gestational hypertension and preeclampsia, similar to studies of SRBD and hypertension in non-pregnant adults. A systematic review reported OR 2.4 of pregnancy related hypertension among women with habitual snoring or moderate to severe OSA.²⁵

Therapeutic intervention has been shown to improve health outcomes in women. In a study of 11 women with preeclampsia and mild SDB, one night of CPAP reduced mean systolic (128 mmHg vs 146 mmHg) and diastolic (73 mmHg vs 92 mmHg) blood pressure compared with a baseline night without treatment in the same women.²⁶ In another study, 12 women with preeclampsia, a single night of CPAP in the third trimester improved cardiac output and reduced peripheral vascular resistance, whereas no improvement occurred in a nontreated preeclampsia group.²⁷ Larger sample sizes are needed to be powered to assess gestational outcomes. A phase III clinical trial is underway with 2,700 women to examine whether treating SDB in pregnancy reduces the risk of gestational hypertensive disease.²⁸


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Given our current level of knowledge, pregnant women who have even mild sleep apnea should be treated for their SRBD. Questionnaires are an effective and efficient way to educate patients and screen for SRBD, treatment of which will benefit maternal and fetal outcomes while possibly serving to optimize craniofacial growth from infancy into adolescence and beyond. It is time to consider vigilance of maternal SRBD as the first step towards the earliest intervention to prevent SRBD along life's journey from neonate to adult.

Screening and treatment of SRBD in pregnant women requires an interdisciplinary approach. Dentists can and do play an essential role in the multidisciplinary care of patients with certain sleep related breathing disorders and are well positioned to identify patients, including pregnant women, at greater risk of SRBD. The American Dental Association encourages dentists to screen patients as part of a comprehensive medical and dental history to recognize symptoms such as daytime sleepiness, snoring or witnessed apneas and

to evaluate risk factors such as obesity, retrognathia, age and hypertension. Whenever a risk is determined, patients can be referred to appropriate physicians for sleep testing and diagnosis. Pregnant women should undergo serial monitoring with questionnaires as SRBD increases from the first to the third trimester. If the onset of SRBD occurs during pregnancy, sleep testing 3-6 months postpartum is recommended to evaluate if the SRBD has been resolved. When SRBD is diagnosed, there are many treatment options including CPAP and oral appliance therapy. Dentists with training in dental sleep medicine can fabricate a custom oral appliance to optimize the airway and breathing pattern. There are also simpler temporary appliances that can be fit and delivered at the first visit if necessary.

Dentists and physicians can collaborate to enhance health outcomes of mother and fetus. We can even gift the expectant mother one of the many great books available to help her and her newborn along their way to optimal health. 

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- Who has an essential role in screening for SRBD in pregnant women?
 - Primary Care Physician
 - Obstetrician
 - Dentist
 - All of the above
- If the SRBD is pregnancy onset, post-partum maternal follow-up is important _____.
 - never
 - always
 - only when newborn has symptoms
 - only when mother has symptoms
- A diagnosis of OSA in pregnant women is associated with _____.
 - Hypertensive disorders of pregnancy
 - Insulin resistance
 - gestational diabetes
 - poor fetal outcomes
 - All of the above
- During pregnancy several factors increase the risk of SRBD including _____.
 - estrogen level rise
 - progesterone level changes
 - weight gain
 - age
 - all of the above
- Newborns of SRBD mothers have a risk for preterm birth and the development of dental arch discrepancies causing them to have increased orthodontic needs. The most common orthodontic problem is _____.
 - Crossbite
 - Spaces between teeth
 - Crowding
 - Anterior Open bite
 - Deep bite
- Fetal Hiccups may represent programmed isometric inspiratory muscle exercise in preparation to postnatal respiratory function and is considered healthy. Maternal SRBD causes _____.
 - Increase in hiccup activity
 - Decrease in hiccup activity
 - Can be restored with intervention
 - a and c
 - b and c
- Fetal growth restriction affects what percentage of all pregnancies?
 - 5%
 - 10%
 - 20%
 - 30%
 - 50%
- The odds of having pregnancy related hypertension is increased more than 2 fold in women with _____.
 - Habitual snoring
 - Moderate OSA
 - Severe OSA
 - All of the above
- SRBD may link preeclampsia with which fetal movement pattern?
 - increased movement
 - decreased movement
 - Intervention with CPAP improved fetal movement condition
 - a and c
 - b and c
- Newborns of OSA mothers have an OR of congenital abnormalities of _____.
 - 1.5
 - 2.3
 - 3.0
 - 4.3
 - 5.5