

The Relationship Between Obstructive Sleep Apnea & Diabetes

- The normal sleep cycle is closely related to endocrine and metabolic functions. Numerous studies have shown a relationship between OSA and diabetes. ^(1,2,3,4,5)
- There have been various studies highlighting the relationship between insulin resistance and the development of cardiovascular disease. OSA may be associated with this relationship due to OSA-related hypoxemia, or an exaggerated sympathetic response seen with undiagnosed or untreated OSA. ^(5,6)
- Increasing hypoxemia during sleep was independently associated with glucose intolerance, on the basis of either fasting glucose values or two hour glucose values. ⁽³⁾
- OSA has been associated with development of insulin resistance. ^(1,2,3,7,8,9)
- OSA has been associated with higher odds of metabolic dysfunction after adjustment for age, gender, smoking status, BMI, waist circumference, and self-reported sleep duration. ⁽³⁾

Prevalence of Diabetes, Obesity & OSA

- During the past 20 years, the prevalence of obesity and type 2 diabetes in the U.S. has increased. ⁽¹⁰⁾
- The prevalence rate of OSA in adults with type 2 diabetes with an AHI of > 15 events/hour is 36 percent.
 - 49% of male participants with an AHI > 15 had type 2 diabetes ⁽⁵⁾
 - 21% of female participants with an AHI > 15 had type 2 diabetes. ⁽⁵⁾
- Self-reported diabetes was three to four times more prevalent in subjects with an AHI >15 ⁽⁶⁾
- The incidence of developing type 2 diabetes after four years with an AHI > 15 was 1.62 when adjusted for age, sex and BMI ⁽⁶⁾
- Insulin resistance and glucose intolerance is shown to rise correspondingly with increasing levels of OSA after adjusting for age, gender, race, BMI, waist circumference and smoking history.

What are the Signs & Symptoms of Obstructive Sleep Apnea?

If you or someone you know snores regularly and has one or more of the following symptoms, it may be OSA.

Check the following symptoms that apply:

- Snoring, interrupted by pauses in breathing
- Gasping or choking during sleep
- Restless sleep
- Excessive sleepiness/fatigue during the day
- Large neck size
(greater than 17" in men;
greater than 16" in women)
- Crowded airway
- Morning headache
- Poor judgment or concentration
- Irritability
- Memory loss
- High blood pressure
- Depression
- Obesity

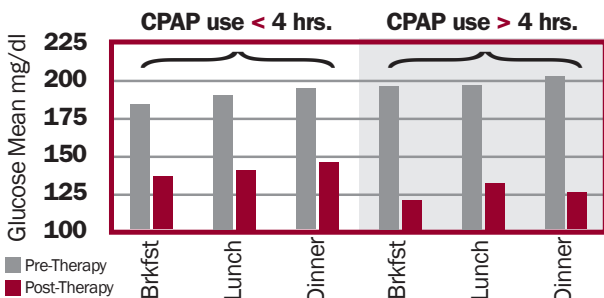
Effects of CPAP Therapy on Diabetes

Within 48 hours, significant improvements have been demonstrated in insulin sensitivity using CPAP therapy.

- Controlling insulin sensitivity and therefore blood glucose is the key goal for diabetes patients

After-meal blood glucose levels can be reduced with compliant CPAP therapy ⁽¹⁰⁾

- Suggests that sustained CPAP use may be an important therapy for diabetics with sleep apnea



1. Einhorn, D., et al., *Endocr Pract* 2007; 13;4:355-362
2. Reichmuth, K.J., et al., *Am J Respir Crit Care Med* 2005; 172:1590-1595
3. Punjabi, et al., *Am J Epidemiol* 2004; 160:521-530
4. Babu, et al., *Arch Intern Med* 2005; 165:447-452
5. Nilsson, et al., *Diabetes Care* 2004;; 27:2464-2469
6. Resnick, et al., *Diabetes Care* 2003; 26:702-709
7. Harsch, I.A., et al., *Respiration* 2004; 71:252-259
8. Vontzas, A.N., et al., *J Clin Endocrinol Metab* 2000; 1151-1158
9. Ip, M.S., et al., *Am J Respir Crit Care Med* 2000; 165:670-676
10. Chasens, E.R., *The Diabetes Educator* 2007; 33:475-482
11. Ip, et al., *Sleep and glucose intolerance/Diabetes mellitus, sleep med clinic* 2007