



Effect of Exercise on Obstructive Sleep Apnea Syndrome

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ABSTRACT

Obstructive sleep apnea Syndrome (OSAS) which is characterized by repetitive complete and/or partial collapses of the upper airways is a common medical condition. OSAS is associated with a variety of long-term consequences such as high rates of morbidity and mortality. Treatment options on OSAS have been discussed in the literature. Exercise training provides improvement in OSAS severity. Underlying mechanisms of exercise treatment for OSAS are unclear and complex. The aim of this study is to present recent developments in the field of effect of exercise in patients with OSAS. The effect of exercise in reducing the severity of sleep apnea in patients with OSA with minimal changes in body weight has been explained by the results of most studies. Exercise may affect sleep by many different mechanisms. Researches investigating the role of exercise mechanism on OSAS need to be improved.

Keywords : Obstructive sleep apnea syndrome, physical exercise

INTRODUCTION

Obstructive Sleep Apnea Syndrome (OSAS) is a common form of sleep disorders characterized by repetitive complete and/or partial episodes of upper airway obstruction during sleep (American Sleep Disorders Association, 2005). Sleep is restorative in daily functioning and intrinsically important in sustaining physical and psychosocial well-being (Lee et al., 2009; Vandekerckhove & Cluydts, 2010). However, impaired sleep quality by fragmentation during night leads to cognitive impairment and daytime sleepiness in the patients with sleep disorders (Beebe et al., 2003). Actually, Obstructive Sleep Apnea (OSA) is not only a disorder of the upper airway, in the meanwhile OSA has potentially severe health consequences, such as arterial hypertension, coronary artery disease, heart failure, arrhythmias, stroke, and type 2 diabetes mellitus (Jaffe, Kjekshus, & Gottlieb, 2013; Pamidi & Tasali, 2012).

OSAS & EXERCISE

The underlying pathophysiology of OSA is unclear and complex. For this reason, treatment options for OSA are confusing. Continuous positive airway pressure therapy is recommended as gold standard by American Academy of Sleep Medicine (Kushida et al., 2006). Other treatment options, such as oral appliances, weight loss, and upper airway surgery, only partially reduce OSA severity (Franklin et al., 2009; Lim, Lasserson, Fleetham, & Wright, 2006). Recent studies suggest that self-reported physical activity is positively associated with better sleep quality in general populations (Sherrill, Kotchou, & Quan, 1998). Similarly, physically active patients with OSA experience less severe OSA symptoms compared to those who are less active (Peppard & Young, 2004). Most of the studies on exercise training have indicated improvement in OSA symptoms and quality of life (Giebelhaus, Strohl, Lormes, Lehmann, & Netzer, 2000; Netzer et al., 1997; Norman, Von Essen, Fuchs, & McElligott, 2000). Underlying mechanisms of exercise training which lead to improve in OSA are not well-understood by scientific papers. Effect of exercise on OSA in previous studies has been explained as indirect facilitation of decrease in body weight and fat. However, recent studies have indicated that positive effects of exercise in the patients with sleep apnea are independent of body weight reduction (Awad, Malhotra, Barnett, Quan, & Peppard, 2012; Giebelhaus et al., 2000; Kline et al., 2011; Peppard &

Young, 2004; Sengul et al., 2011). These experimental studies with small sample size have found the apnea-hypopnea index (AHI) to be reduced up to 50% following chronic exercise training (Giebelhaus et al., 2000; Norman et al., 2000; Sengul et al., 2011).

Netzer and co-workers (Netzer et al., 1997) reported the effects of exercise in patients with sleep apnea based on the idea that chemoreceptor sensitivity had enhanced following physical exercise in the athletes, and, thus, breathing improves. Their study results showed a significant improvement in AHI following a 6-month exercise program in the patients with moderate to severe OSAS. They suggested that improvement of OSA severity might be due to a possible rise in the respiratory drive or muscle tonus of the upper airway after exercise although body weight did not change. These results were confirmed by the results of other studies (Giebelhaus et al., 2000; Peppard & Young, 2004). Giebelhaus et al. (Giebelhaus et al., 2000) suggested that no change occurred in body mass index (BMI) and body weight of the patients with OSA included in exercise program for 6 months, twice a week for 2 hours consisting of power and aerobic exercises. Similarly, Peppard et al. (Peppard & Young, 2004) showed that exercise habits of different extent had no effect on body shape and composition. In contrast to these results, two studies indicated that regular physical activity reduces the severity of OSAS by reducing body weight or strengthening respiratory muscles (Hong & Dimsdale, 2003; Norman et al., 2000).

Recent studies have received accelerated attention on exercise training in patients with sleep apnea. Sengul et al. (Sengul et al., 2011) reported improvements in exercise capacity, AHI, quality of life, and quality of sleep after a 12-week program of breathing and aerobic exercises in patients with mild to moderate OSAS. This randomized and controlled trial did not show changes in the anthropometric measurements and respiratory functions of patients with OSAS. Similar results were obtained by Kline and co-authors in the patients with moderate to severe OSAS. Exercise group were applied aerobic and resistance exercises and control group performed stretching exercises 12 weeks. This study showed improvement in sleep quality and in AHI, without decrease in body weight (Kline et al.).

The role of exercise in OSAS

A meta-analysis has analyzed data of the studies on severity of OSA in adults. Results of this study showed that exercise plays an important role in reducing the severity of sleep apnea in patients with OSA with minimal changes in body weight (Iftikhar, Kline, & Youngstedt, 2013). The positive effect of exercise on OSA patients is well-known although its underlying mechanism is not known except for some hypotheses and theoretical reviews. Exercise may affect sleep by many different mechanisms, but there are not enough researches on experimental exercise training to find out these mechanisms. Some hypotheses have been suggested by authors who work on these clinical studies. Basic hypotheses proposed by Driver and Taylor (Driver & Taylor, 2000) are thermogenic, conservation of the energy, and body restoration and these mechanisms are thought to affect sleep cycles (Youngstedt, O'Connor, & Dishman, 1997).

Some studies indicated that possible cause of improvement in sleep apnea severity, without change in body weight, was increased muscle tonus of the upper airway or of the respiratory muscle (Giebelhaus et al., 2000; Netzer et al., 1997). Based on the study by O'Donnell et al. (O'Donnell, McGuire, Samis, & Webb, 1998), increasing inspiratory and expiratory pressure provided improvement on sleep parameters by aerobic exercises in patients with OSAS (Norman et al., 2000). Contrary to this hypothesis, Sengul et al. (Sengul et al., 2011) applied aerobic and breathing exercises and determined no change

in the strength of respiratory muscles. Recent researchers suggested that in leg fluid accumulation may be decreased by exercises. Especially, prevention of nocturnal rostral fluid accumulation can decrease the collapsibility of upper airway by physical exercise (Mirrakhimov, 2012).

Most of the authors believe that exercise training can modulate inflammatory profile in patients with OSA. Physical exercise may alter cytokine plasma concentrations and profile. (Santos, Tufik, & De Mello, 2007). In addition, metabolic hypothesis which demonstrates inflammation of the upper airway related to the visceral fat tissue appears as a systemic condition. Especially results of most of the studies showed decreased sleep severity despite not change in breathing function and body weight. Metabolic hypothesis stands out recently because of the data above.

CONCLUSION

In conclusion, we cited some studies indicating that exercise training leads to a significant reduction in AHI, improvement in sleep quality, and daytime sleepiness, independent of the effect on BMI. Exercise may affect sleep by many different mechanisms, but there are not enough researches on clinical exercise training to find out these mechanisms. Further studies can also explain the role of exercise mechanism in patients with OSA. Randomized controlled trials with larger sample size are needed in this field.

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