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# **Integrated Activity CPAP and BiPAP Machine for Sleep APNEA**

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**ABSTRACT:** Sleep apnea is a disorder that patients experience during sleep because of pauses in breath. The breath pauses usually remain for seconds to minutes and they might happen some times during night and it causes loud choking or snorting sounds when breathing is resumed. As it disturbs normal sleep, patients affected might feel sleepiness or tired in case of day time. In order to cure sleep apnea disorder, the breathing assistants like CPAP and BiPAP machines are used. CPAP devices are the best for treatment of OSA and can monitor during sleep and BiPAP is suggested for patients who are suffering with both OSA and CSA. The lack of treatment for both OSA and CSA might lead to heart attack, stroke, diabetes, heart failure, and irregular heartbeat. The overview of our project is to get people know the awareness of sleep apnea disorder and make the low-cost integrated CPAP and BiPAP machine as single non-invasive method working model.

**KEYWORD:** Sleep disorder, pause, CPAP, BiPAP, Breath

## **I. INTRODUCTION**

The patient with OSA includes muscle relaxation at their mouth and pharynx and then on the soft tissue the patient tongue is dropped in the mouth's roof and also pressed it against at throat back. This air flow is blocked and then normal breathing is not happened in patient, it is because the upper airways through which air goes to the lungs is blocked by tongue, it will decrease the body's oxygen level. Then the patient suddenly wakes up from the bed to make them available with good atmosphere in order to increase body's oxygen level. This cycle is repeated as of many times at night and the sleep of the patient being disturbed, thus considered as breathing problem. Some research asserts that sleep apnea cases are due to CSA at 20% approximately. In case of old aged people, it is hard for them to make movement from places in order to get sufficient air supply for breathing while sleeping, causing chronic breathing problem which may end up at death sometimes. To treat cases like these, researches were also conducted by doctors and came up with high yielding technology that comprises of CPAP and BiPAP machines. These CPAP and BiPAP can be used for patient's depending upon the doctor's suggestion.

### **A. SLEEP APNEA**

Sleep apnea is the commonest serious sleep disorders in which the patient's breathing is compactly break in during their sleep. Most of the patient's suffering from sleep apnea are not conscious of the short breathing episodes that happens hundreds of times at night and jolting of the patient that disturbs their natural sleep rhythm. The patient may feel that they are exhausted, not mentally sharp, or productive during the day in comparison to a normal person and also many people ill-treat snoring as a joke or something to be embarrassed about.



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## II. LITERATURE REVIEW

In paper “*Is Obstructive Sleep Apnea more Prevalent than Central Sleep Apnea in Patients with Systolic Heart Failure? A Retrospective Study*” by Hasan A, Uzma N, Abdullah F, Hannan HA, Narasimhan C says Central Sleep Apnea (CSA) rather than Obstructive Sleep Apnea (OSA) is widely believed to be the dominant form of sleep apnea in patients with heart failure. A retrospective data - analysis was done in 65 consecutive patients with stable mild-to-moderate HF referred for evaluation based on fatigue regarded by cardiologists.

Also in paper “*CPAP with Pressure Relief during Exhalation (C-Flex+) is as Effective as CPAP in the Treatment of Obstructive Sleep Apnea*” by Krawietz M, Garcia C, Pilz C, Glos M, Penzel T says there was no significant difference between the therapy modes in the apnea/hypopnea index. The sleep efficiency, sleep architecture and nocturnal oxygenation were also comparable. Most patients preferred C-Flex over CPAP (65%,  $p < 0.001$ ). C-Flex was as effective as CPAP therapy in treating OSA and patients preferred this mode of therapy.

“*Effects of the Presence of One or More Comorbidities Using an Educational Intervention on CPAP Compliance*” by Sokolow, Valerie says the efficacy of tonsillectomy in reduction of respiratory disturbance index (RDI) and other sleep study parameters in patients with obstructive sleep apnea (OSA). All 34 patients were treated with tonsillectomy, as the only surgical treatment for OSA from 2007 to 2011 in this paper.

## III. TYPES OF APNEA

### A. OBSTRUCTIVE SLEEP APNEA

OSA is the commonest type of sleep apnea. This is caused because of some physical block caused to the airflow while sleeping. While being awake, the throat muscles keep the airway stiff and open that allows air to pass into the lungs. However, while sleeping, these throat muscles get relaxed and thus throat becomes narrower. This is normal and should not affect the lungs airflow. But in case of sleep apnea, airway gets blocked usually and enough air cannot reach the lungs. When air squeezes past the blockage then starts snoring.

#### a. Central sleep apnea

CSA is exceptional. Here the airway is not blocked and this type is rather caused by the brain, since it fails to send the right signals to the muscles for breathing. Consequently, the body will not make any effort for breathing. Since there is no block, Snoring does not usually happen for people with CSA. The main reasons behind CSA are due to heart disorders, stroke, and brain tumors.

#### b. Complex sleep apnea

Some patients having sleep apnea disorder experience both the combination of OSA and CSA. This state of disorder is called as mixed or complex sleep apnea.

### B. TREATMENT METHODS

Therapeutic methods for central and complex sleep apnea usually includes treating of any underlying medical condition that causes the apnea, like heart or neuromuscular disorder and uses oxygen supplemental and breath assisting devices during sleep.

Therapeutic options for obstructive sleep apnea are,

- CPAP
- BiPAP

**IV. DEVICE DESCRIPTION****A. CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)**

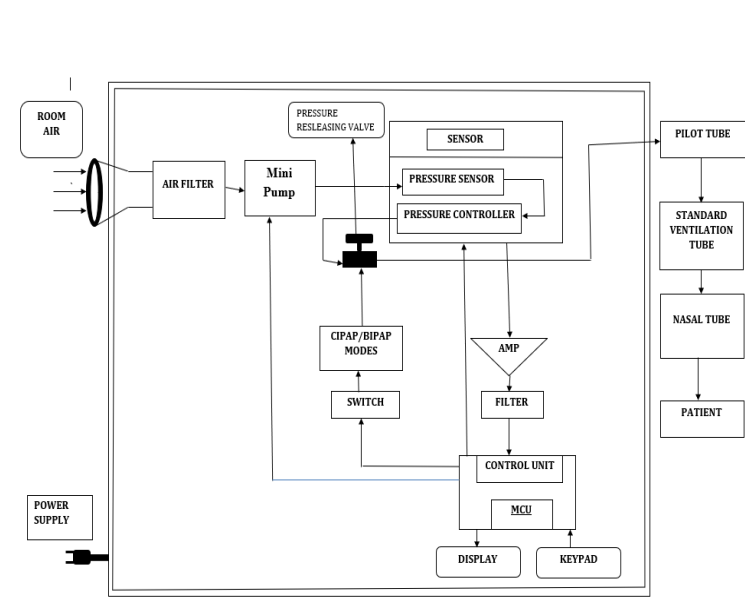
CPAP devices are commonly used devices for treatment options for people facing breathing problems, most in particular of which is obstructive sleep apnea (OSA). Depending up on the severity level of one's sleep apnea, patients may experience episodes from 5 to 100 interruptions per hour while breathing. CPAP motors are tremendously quiet. The hose is nothing but a delivery device which exchanges the pressurized air from the motor to the wearer's mask.

**B. BiLEVEL POSITIVE AIRWAY PRESSURE (BiPAP)**

A Bilevel Positive Airway Pressure (BiPAP) is a therapeutic device suggested for patients with Obstructive Sleep Apnea (OSA), central sleep apnea (CSA), COPD or other complex breathing-related disorder. The machine assists to deliver the required oxygen pressure into the lungs and hence maintaining the airways open in order to avoid uncooperative events. These devices are much capable of modifying better to the changes in breathing patterns, and the devices can assist patients systematically in case of sleep apnea disorder.

**C. MAXIMUM PRESSURE RATE FOR CPAP AND BiPAP****Table.1.1 Pressure Range of CPAP and BiPAP**

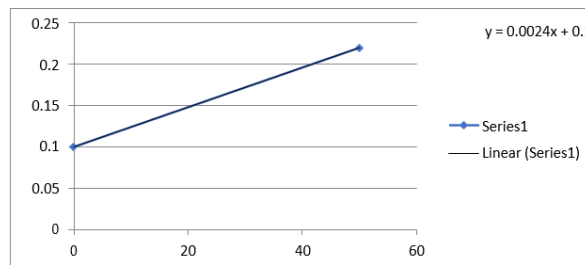
Parameter	Control Range	Control Instruments
IPAP	40 cm H <sub>2</sub> O	1 cm H <sub>2</sub> O
EPAP	20 cm H <sub>2</sub> O	1 cm H <sub>2</sub> O
CPAP	20 cm H <sub>2</sub> O	1 cm H <sub>2</sub> O
Rate	40 BPM	1BPM
Time Inspiration	0.05 to 0.3 sec	0.1 sec
IPAP Rise Time	0.05 to 0.4	set points 0.05,0.1,0.2,0.4 sec
Oxygen Concentration (% O <sub>2</sub> )	1 to 100%	4% from 21% to 25% 5% from 25% to 100%

**V.METHODOLOGY****A. BLOCK DIAGRAM****Figure 1 Block Diagram of CPAP and BiPAP machine****VI. RESULT AND DISCUSSION**

In case of sleep apnea disorder, an assisting CPAP and BiPAP prototype manual device for OSA and CSA treatment purpose is developed. This particular device allows to choose optional modes regarding the doctor's suggestion. As it is a manual prototype model, which comprises of two varying modes in two devices have been integrated and developed into one device. Once the required mode is chosen, we have programmed a fixed pressure set delivery of 10cmH<sub>2</sub>O. This is the output pressure delivered from the pump.

Input		Output	
X1(Minimum sensor output voltage)	0.1	Y1(Output pressure)	0
X2(Maximum Sensor output voltage)	0.22	Y2(Output pressure)	50

**Figure 2 Pressure Output**



**Figure 3 Pressure Output Graph**

## VII. CONCLUSION AND FUTURE SCOPE

CPAP and BiPAP are combined into one device. The main advantage is that despite of usage of two varying and separate devices, the interfaced single device which can be give larger hand when used according to the suggestion of doctors. These devices enhance in treatment of both OSA and CSA. This prototype model had been developed in an affordable manner. In future work, CPAP and BiPAP machine, the pressure delivered manually in our present project can be moderated into an automatic pressure controlling device. In India, this device has not yet been manufactured as people are not aware of this particular Sleep Apnea disorder.

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