

# Assessing Public Awareness and Understanding of Obstructive Sleep Apnea: A Survey Study Highlighting Knowledge and Perceptions

Dr. Y. Ravi Shankar<sup>1</sup>, Dr. Himabindu Vanipenta<sup>2</sup>, Dr. T. Satyendrra Kumar<sup>3</sup>,  
Dr. R. Himabindu<sup>4</sup>, Dr. K. Srinivas<sup>5</sup>, Dr. B. Srinivas Rao<sup>6</sup>

<sup>1</sup>Chair (Acad, Acad, and adms); Oral Implantology, Professor, Department of Prosthodontics; GITAM Dental College & Hospital.

Mail id: [drvishankar22\[at\]gmail.com](mailto:drvishankar22[at]gmail.com)

Ph no.: 9885307066

<sup>2</sup>MDS, Department of Prosthodontics; GITAM Dental College & Hospital

Mail id: [himabinducm1111\[at\]gmail.com](mailto:himabinducm1111[at]gmail.com)

Ph no.: 9030888349

<sup>3</sup>Associate Professor, Department of Prosthodontics; GITAM Dental College & Hospital

Mail id: [satya15292\[at\]gmail.com](mailto:satya15292[at]gmail.com)

Ph no. :9490991243

<sup>4</sup>Professor, Department of Prosthodontics, GITAM Dental College & Hospital

Mail id: [himabinduravella\[at\]gmail.com](mailto:himabinduravella[at]gmail.com)

Ph no. : 8106658282

<sup>5</sup>Head of the Department, Department of Prosthodontics, GITAM, Dental College & Hospital

Mail id: [srinivaskallurimds\[at\]gmail.com](mailto:srinivaskallurimds[at]gmail.com)

Ph no. : 9000815641

<sup>6</sup>Professor, Department of Prosthodontics, GITAM Dental College & Hospital

Mail id: [drsrinivasmds\[at\]gmail.com](mailto:drsrinivasmds[at]gmail.com)

Ph no. : 9980477725

**Abstract:** Introduction/ Background: Obstructive sleep apnea (OSA) is a common Sleep disorder characterized by recurrent episodes of narrowing or collapse of the pharyngeal airway during sleep despite ongoing breathing efforts. OSA shows link with hypertension, and higher cardiovascular risk which causes substantial morbidity and mortality in all countries. However, OSA is often under-diagnosed and its prevalence is increasing. It is a very common condition and there has been a dangerous rise in the prevalence of OSA. This is likely due to a combination of factors such as obesity, alcoholism, ageing population, systemic and anatomic conditions. This survey was conducted to access the knowledge of the general population regarding OSA. Aims and objectives: The purpose of this survey is to assess the level of awareness and knowledge of OSA among the general population and their knowledge on Prosthodontic approach to treat OSA. Methods: A cross-sectional survey study was carried out using a 12-item self-administered questionnaire (not validated) that assessed the knowledge of OSA among the general population. This questionnaire was designed for general population and was prepared in English and translated to Telugu for ease of understanding among local population. The questions were regarding knowledge about OSA, related risk factors, symptoms, complications and treatment of OSA. The survey was collected through paper. Responses were recorded, compiled and statistically analyzed to determine correlation of responses. Results: Among 400 respondents 232(58%) were aware of obstructive sleep apnea. 79(19.8%) of the participants were getting treated for sleep related issues. A total of 247(61.7%) were aware of at least one health consequence if OSA persists. 10% of the participants were using commercially available anti snoring devices. 7.8% of the total participants choose the oral appliance therapy can be advantageous though none among the 400 participants underwent any appliance therapy to treat OSA. Conclusion: Subjects showed a low level of awareness in all aspects of OSA. Their lack of knowledge indicates the need for medical and dental professionals to improve awareness and knowledge of OSA and considerable educational effort is needed to increase awareness.

**Keywords:** Obstructive sleep apnea, Sleep related issues, Anti snoring devices

## 1. Introduction

Obstructive sleep apnea (OSA) is a sleep condition characterized by recurrent collapse of the upper airway tract during sleep, which leads to repetitive episodes of desaturations and arousals. The pharyngeal collapse could be either complete which causes apnea or partial which causes hypopnea. Fluctuations in gas exchange leads to oxygen desaturation, hypercapnia and sleep fragmentation, all of which contribute to further consequences of obstructive

sleep apnea. Features of OSA include snoring, witnessed apnea, excessive daytime sleepiness, depression and increased risk of cardiovascular diseases such as hypertension, stroke, and metabolic diseases such as diabetes which can result in even death. These symptoms are more likely due to the contributing factors such as obesity, age and sedentary lifestyles<sup>(1,2)</sup>.

Sleep disorders and excessive sleepiness are caused due to poor sleep hygiene such as poor sleep habits, poor planning

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of sleep time and voluntary sleep deprivation with chronic ingestion of coffee, tea or antihistamines. Evidence suggests that sleep disorders are relatively common, and sleepiness impacts increased risk for fatigue-related car accidents, errors and other accidents<sup>(3)</sup>. Sleep apnea decreases the quality of life and work productivity and also imposes a health risk to patients<sup>(4)</sup>. Although there are various treatment protocols; sleep apnea treatment is often poorly tolerated or only partially alleviates abnormalities. Therefore, there should be an increase in patients getting treated, getting attached to the existing treatments and there is a need to develop new treatments or a combination of treatments.

OSA is a highly under-diagnosed health condition and its prevalence is increasing. This contributes to a great public health burden<sup>(1)</sup>. Despite its high prevalence rate, it has been reported that majority of subjects in these studies did not receive a prior physician diagnosis of sleep apnea<sup>(5)</sup>. Hence we hypothesize that knowledge of OSA among the general population remains poor, contributing to a large proportion of undiagnosed OSA subjects. A survey examining the levels of awareness and knowledge of OSA among the general population is necessary. In this study, we conducted a survey to assess current awareness, knowledge and attitude of general population towards OSA.

## 2. Methods

A cross-sectional survey study was carried out among the general population. A total of 400 members participated in the study; Out of which 260 were females and 140 were males and all the participants were above the age of 40 years. The study was conducted using a 12-item self-administered questionnaire which was formed in English and then translated to Telugu for ease of understanding among the local population.

Questionnaire assessed the knowledge of OSA. The knowledge questions consisted of the meaning of OSA, main symptoms, complications, diagnosis, and general and prosthodontic approach in treatment of OSA. The knowledge assessment questions were carried as multiple-choice questions with one or more correct answers and yes/no answered questions.

### OSA awareness questionnaire

The first question of the questionnaire survey was related to awareness of OSA. The subjects were asked: "Are you aware of a condition called obstructive sleep apnea?": respondents gave yes/ no to this question and definition were explained to them to understand this medical term if they answered no and the rest of the study was continued. The second question was "Are you having any of the following symptoms:" this was a multiple choice question to which multiple answers can be chosen, the options were- Snoring, Witnessed apnea (temporary cessation of breathing, especially during sleep), Frequent nocturia(excessive urination during nights), Excessive daytime sleepiness, Depression and Loss of concentration. The third question was "Do you know the following health consequences occur if OSA persists", this was a multiple choice question to which multiple answers can be chosen, the options were-

Excessive daytime sleepiness, Head ache, Hypertension, and Diabetes mellitus, Heart problems and Increased mortality. The fourth question was "Do you know OSA is treatable?", Respondents gave yes/ no to this question. The fifth question was "Are you under any of the treatments for treating OSA" a Yes/ No question; if yes the participants answered the next question that was "Did you consult any of the following doctors for this problem?", the participants choose between - General physician, ENT specialist, Dentist, Ayurveda/ Homeopathy doctors.

Next question was "Are you having the habit of bruxism during sleep?", "Do you know that other conditions like bruxism can also be treated along with OSA using appliance therapy?", "Do you use any commercially available anti snoring devices?", "What is your opinion on advantages of using anti snoring devices?", "Do you know the following treatments like Continuous positive airway pressure (CPAP), Surgery, Oral appliances, Weight loss, Positional therapy, Treating nasal allergies, Exercises, medicines exist for treating OSA?", "Do you know the advantages and ease of using oral appliance therapy?". To which yes/ no was chosen by subjects.

Responses were recorded compiled and statistically analyzed using Pearson chi square test to determine correlation of responses. All statistical tests were two-sided and performed at a 5% level of significance ( $p < 0.05$ ).

## 3. Results

232(58%) of total respondents were aware of obstructive sleep apnea out of which 42.3% were females and 87.14% of males were aware of the condition (Table1, Graph 1).

About 320(80%) have at least one or more symptoms in which almost all have the symptom of snoring. Snoring and nocturia combination was opted by 46.5% of females and 50.7% of males and this was the highest when compared to rest of all the combinations. 20% (28.6% of males and 15.4% of females) didn't have any symptoms related to OSA. 10% of the total population (14.3% of males and 7.7% of females) had all the symptoms in options (Table2, Graph 2).

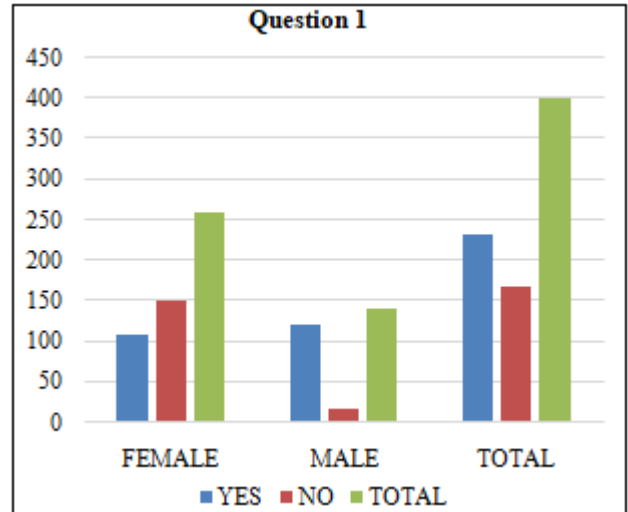
A total of 247(61.7%) were aware of at least one health consequence (out of all health consequences listed i.e., excessive daytime sleepiness; head ache; hypertension; Diabetes mellitus; heart problems; frequently death) if OSA persists; maximum of them knew that headache and excessive daytime sleepiness were consequences and 153(38.3%) of total respondents didn't know any of the health consequences (Table3, Graph 3).

Respondents who were aware that OSA is treatable were about 285(71.3%) (Table4, Graph 4) but only about 79(19.8%) were getting treated for OSA (Table 5, Graph 5). For the sixth question respondents getting treated for OSA answered as 43(10.8%) getting treated under General physician, 5(1.3%) under the treatment of an ENT specialist, 28(7%) getting treated using Ayurveda/ Homeopathy medicine and only 3(0.8%) were getting treated with the help of a Dentist(Table 6, Graph 6). 265(66.25%)

participants somehow noticed bruxism during sleep (Table 7, Graph 7) and 62(15.5%) knew that conditions like bruxism can also be treated along with OSA using appliance therapy (Table 8, Graph 8). 40(10%) have used some kind of commercially available anti snoring devices (Table 9, Graph 9) and 96(24%) felt that using anti snoring devices was advantageous (Table 10, Graph 10). 61(15.3%) knew that treatment options such as Continuous positive airway pressure (CPAP), surgery, oral appliances, weight loss, positional therapy, treating nasal allergies, exercises, medications for OSA exist (Table 11, Graph 11). 31(7.8%) knew advantages and ease of using oral appliance therapy (Table 12, Graph 12).

**Table 1:** Question 1: Are you aware of a condition known as obstructive sleep apnea – a sleep related disorder?

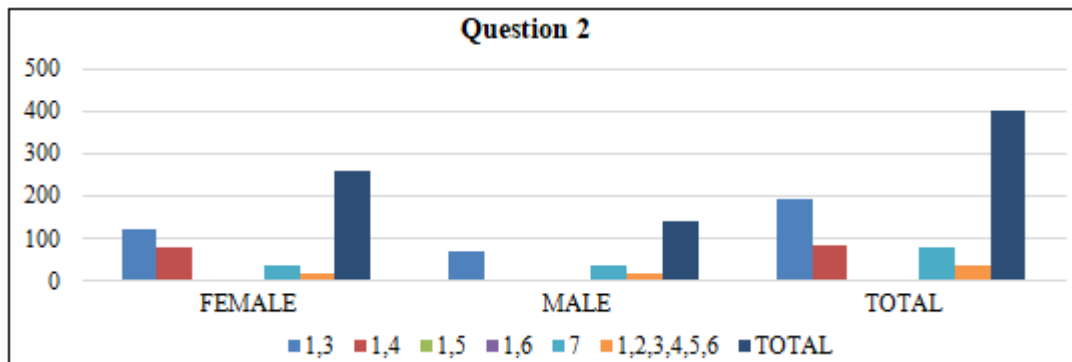
		Yes	No	Total
Gender	Female	110(27.5%)	150(37.5%)	260(65%)
	Male	122(30.5%)	18(4.5%)	140(35%)
	Total	232(58%)	168(42%)	400(100%)
Chi square value= 75.093 **P value-0.000 (Highly statistically significant)				



**Graph 1**

**Table 2:** Question 2: Are you having any of the following symptoms?

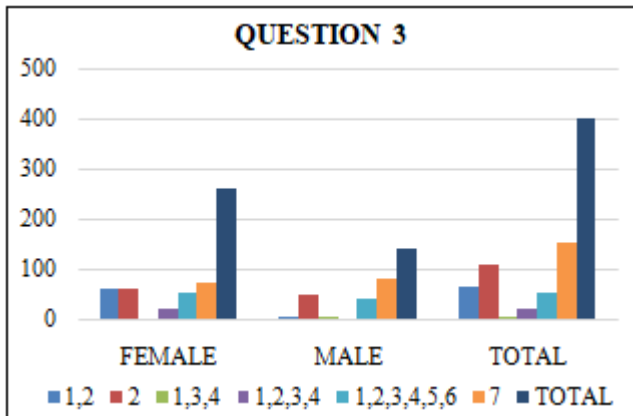
		1,3	1,4	1,5	1,6	7	1,2,3,4,5,6	TOTAL
Gender	Female	121(30.3%)	79(19.8%)	0	0	40(10%)	20(5%)	260(65%)
	Male	71(17.8%)	7(1.8%)	1(0.3%)	1(0.3%)	40(10%)	20(5%)	140(35%)
	Total	192(48%)	86(21.5%)	1(0.3%)	1(0.3%)	80(20%)	40(10%)	400(100%)
Chi square value= 43.187 **P value-0.000(Highly statistically significant)								



**Graph 2**

**Table 3:** Question 3: Do you know the following health consequences occur if OSA persists?

		1,2	2	1,3,4	1,2,3,4	1,2,3,4,5,6	7	TOTAL
Gender	Female	60(15%)	60(15%)	0	19(4.8%)	50(12.5%)	71(17.8%)	260(65%)
	Male	6(1.5%)	48(12%)	4(1.0%)	0	0(5%)	82(20.5%)	140(35%)
	Total	66(16.5%)	108(27%)	4(1.0%)	19(4.8%)	50(12.5%)	153(38.3%)	400(100%)
Chi square value= 91.545 **P value-0.000(Highly statistically significant)								

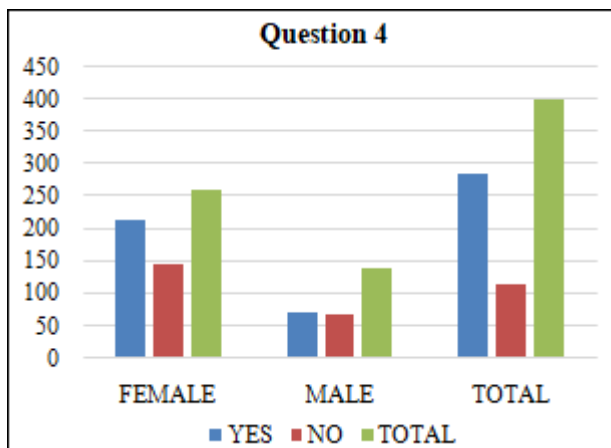


Graph 3

Table 4: Question 4: Do you know OSA is treatable?

		Yes	No	Total
Gender	Female	214(53.5%)	46(11.5%)	260(65%)
	Male	71(17.8%)	69(17.3%)	140(35%)
	Total	285(71.3%)	115(28.7%)	400(100%)

Chi square value= 44.342 \*\*P value=0.000  
(Highly statistically significant)

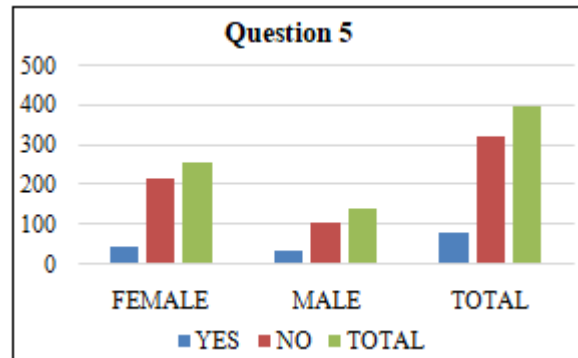


Graph 4

Table 5: Question 5: Are you under any of the treatments for treating OSA

		Yes	No	Total
Gender	Female	44(11%)	216(54%)	260(65%)
	Male	35(8.8%)	105(26.3%)	140(35%)
	Total	79(19.8%)	321(80.3%)	400(100%)

Chi square value= 3.746 \*\*P value=0.000  
(Highly statistically significant)

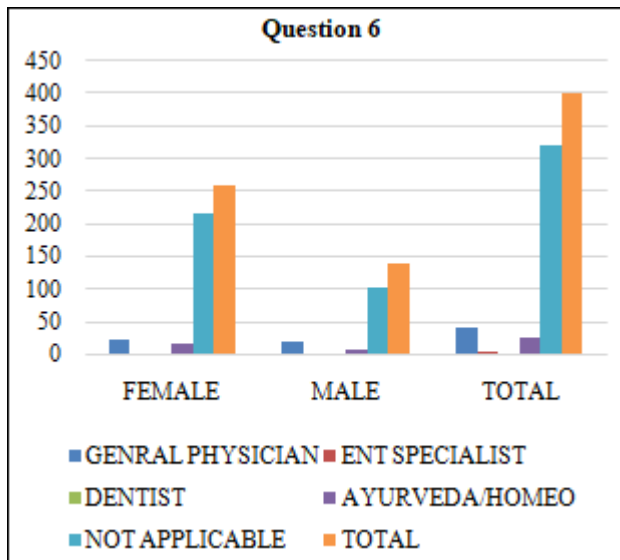


Graph 5

Table 6: Question 6: Did you consult any of the following doctors for this problem?

		General Physician	Ent Specialist	Dentist	Ayurveda/ Homeo	Not Applicable	Total
Gender	Female	23(5.8%)	3(0.8%)	0	18(4.5%)	216(54%)	260(65%)
	Male	20(5.0%)	2(0.5%)	3(0.8%)	10(2.5%)	105(26.3%)	140(35%)
	Total	43(10.8%)	5(1.3%)	3(0.8%)	28(7%)	321(80.3%)	400(100%)

Chi square value= 8.877 P value=0.064

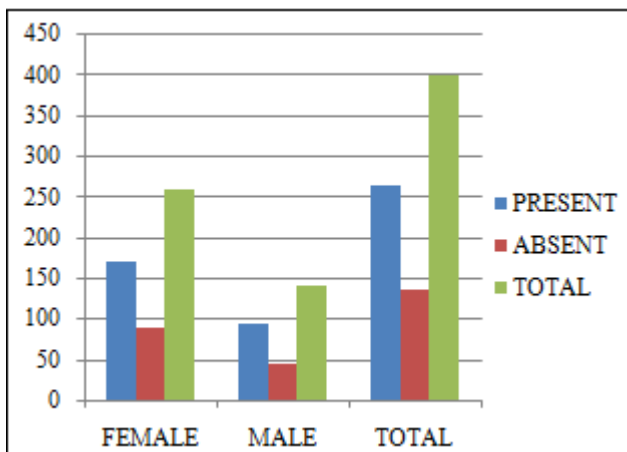


Graph 6

Table 7: Question 7: Are you having the habit of bruxism during sleep?

		Present	Absent	Total
Gender	Female	170(65.4%)	90(34.6%)	260(65%)
	Male	95(23.8%)	45(11.3%)	140(35%)
	Total	265(66.25%)	135(33.75%)	400(100%)

Chi square value= 33.467 \*\*P value-0.000  
(Highly statistically significant)

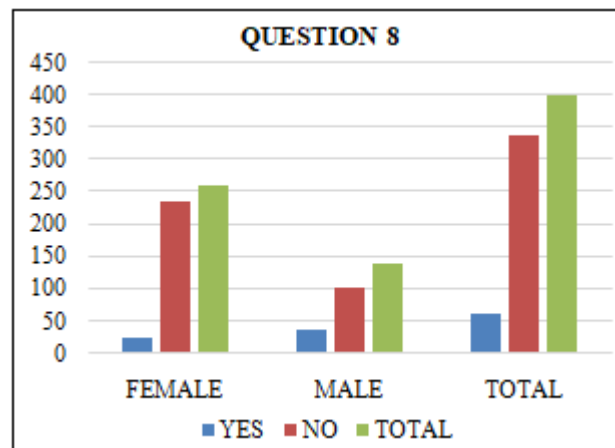


Graph 7

Table 8: Question 8: Do you know the other conditions like bruxism can also be treated along with OSA using appliance therapy?

		Yes	No	Total
Gender	Female	24(6%)	236 (59%)	260(65%)
	Male	38(9.5%)	102(25.5%)	140(35%)
	Total	62(15.5%)	338(84.5%)	400(100%)

Chi square value= 22.292 \*\*P value-0.000  
(Highly statistically significant)

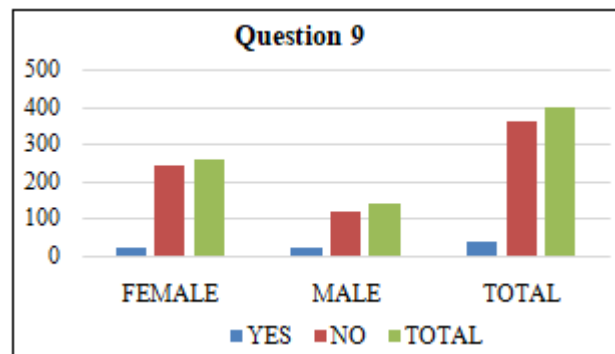


Graph 8

Table 9: Question 9: Do you use any commercially available anti snoring devices

		Yes	No	Total
Gender	Female	20(5%)	240(60%)	260(65%)
	Male	20(5%)	120(30%)	140(35%)
	Total	40(10%)	360(90%)	400(100%)

Chi square value= 4.396 P value-0.036

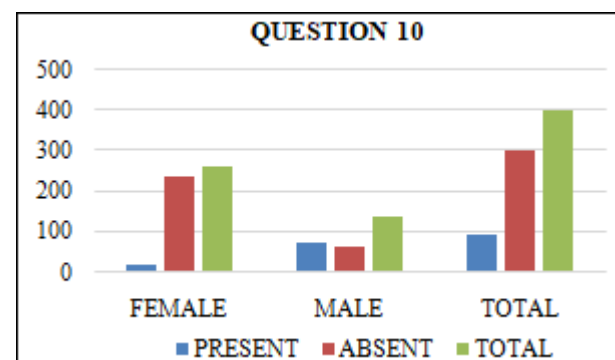


Graph 9

Table 10: Question 10: What is your opinion on advantages of using anti snoring devices?

		Present	Absent	Total
Gender	Female	20(5%)	240(60%)	260(65%)
	Male	76(19%)	64(16%)	140(35%)
	Total	96(24%)	304(76%)	400(100%)

Chi square value= 108.309\*\*P value-0.000  
(Highly statistically significant)

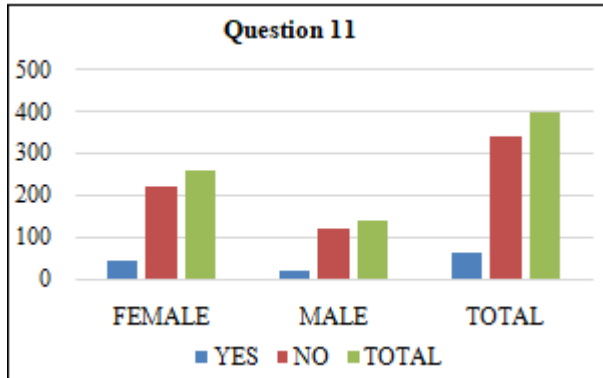


Graph 10



**Table 11:** Question 11: Do you know the treatment options such as Continuous positive airway pressure (CPAP), surgery, oral appliances, weight loss, positional therapy, treating nasal allergies, exercises, medications for OSA exist ?

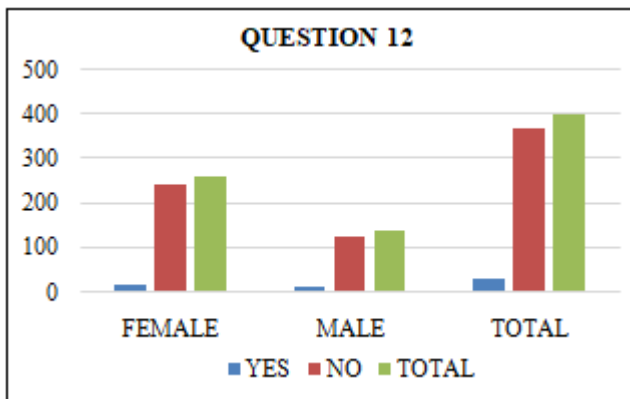
		Yes	No	Total
Gender	Female	41(10.3%)	219(54.8%)	260(65%)
	Male	20(5%)	120(30%)	140(35%)
	Total	61(15.3%)	339(84.8%)	400(100%)
Chi square value= 0.155 P value-0.694				



**Graph 11**

**Table 12:** Question 12: Do you know the advantages and ease of using oral appliance therapy?

		Yes	No	Total
Gender	Female	16(4%)	244(61.8%)	260(65%)
	Male	15(3.8%)	125(31.3%)	140(35%)
	Total	31(7.8%)	369(92.3%)	400(100%)
Chi square value= 2.647 P value-0.104				



**Graph 12**

**Table 13**

Question	Chi square	P value
1	75.093	0.000
2	43.187	0.000
3	91.545	0.000
4	44.342	0.000
5	3.746	0.000
6	8.877	0.044
7	33.467	0.000
8	22.292	0.000
9	4.396	0.036
10	108.309	0.000
11	0.155	0.494
12	2.647	0.104

On statistical analysis the significance values and the chi-square statistic compares the size of discrepancies. (Table 13) clearly indicates the difference between the options. The significance level was set 5 % ( 0.05). Except for question no.11, 12 the rest showed high statistical significance.

#### 4. Discussion

Obstructive sleep apnea (OSA) is a common chronic disorder affecting about 2–4% of the adult population, with the highest prevalence reported among middle-aged men<sup>(6)</sup>. The condition is distinguished by repeated episodes of complete or partial collapse of the upper airway (primarily the oropharyngeal tract) during sleep, resulting in a cessation/reduction of airflow<sup>(7)</sup>. Obstructive events (apneas or hypopnoeas) cause progressive asphyxia, stimulating breathing efforts against the collapsed airway until the person is awakened.

58% of the total population was aware of the condition; this low awareness may be due to a lack of dissemination of knowledge about OSA through the media, education curriculum, or a lack of importance among physicians or other doctors to create awareness or early diagnosis of the problem. "42.3% of females were aware of the condition, while 87.14% of males were aware of the condition," this clearly explains that there is a significant lack of knowledge in females compared to males, with less women reaching healthcare facilities and seeking medical opinion for their symptoms related to OSA<sup>(8)</sup>.

A lot of factors cause snoring making it the most common problem and condition among elderly. The factors include loss of muscle tone, alcoholism, weight gain, debilitating health conditions, medications... etc. Throughout earlier life, women tend to snore less than men. Hormones have been majorly implicated in the gender-related variations, with male hormones like testosterone tending to increase obesity and severity of OSA several mechanisms, while female hormones are promoting airway and ventilatory stabilization<sup>(9)</sup>. This difference continues up to the postmenopausal period; where female tend to catch up with their male counterparts; this gap is narrowed once women reach the menopause as various physiological changes makes more likely to snore. The differences between men and women in the prevalence of OSA decrease as age increases<sup>(10)</sup>. Anthropometric measures may also contribute to the higher prevalence of OSA in men than in women<sup>(11)</sup>. Increased nocturia can not only be due to OSA but can also be due to increased consumption of fluids like water, alcohol, caffeine...etc. Elderly people lose strength in masticatory muscles and prefer mostly fluids which in turn can increase nocturia. Diabetes is yet another and most important factor causing nocturia in both men and women. Nocturia was more common among females as they are easily prone to urinary bladder infections, vaginitis, thyroid issues, decreased estrogen...etc along with the above mentioned causes.

In terms of awareness of the health consequences pertaining to OSA, females were more knowledgeable than males. Both males and females reported headache and increased daytime sleepiness as health consequences. 61.7% are aware of at

least one health consequence. Early morning headaches are common in cases of insufficient sleep at night. This could be due to a variety of factors such as habits, lifestyle, health, and so on.

The majority of females believed that OSA is treatable, whereas only about half of males believed that OSA is treatable. Females are likely to be optimistic and believe that any health condition can be treated. 17% of females and 25% of males were being treated for this health condition with medication. This demonstrates the importance of public health support in creating a need for treatment.

People in India take privilege in believing and following the traditional Ayurveda and Homeopathy medicine to cure any health conditions. Though many of them transformed slowly and started believing in medicine followed worldwide. About 7% of the population was getting treated using Ayurveda and Homeopathy, and 15.8% using Medicine. Only 3 participants that is 0.8% of total population were getting treated under a dentist. Though dentist, in particular a prosthodontist can be of great help in treating such condition, lack of knowledge deprives people from approaching a dentist. The dental curriculum should include this to improve the awareness among dentists which may subsequently increase the awareness among population.

65.4% of females and 67.9% of males said they observed the habit of bruxism whereas 9% of females and 27% of males were getting treated among them. 9% of females and 27% of males knew that habits like bruxism can be treated with oral appliance therapy. Oral appliances (mandibular repositioning devices) are effective treatment options, especially for people who have mild to moderate OSA. According to a 2015 meta-analysis of 34 randomised clinical trials, these devices were linked to a mean reduction in AHI (The presence and severity of OSA are typically quantified by the apnea-hypopnea index (AHI), defined as the number of apneas plus hypopneas per hour of sleep) of 13.6 (95% CI, 12.0- 15.3) events per hour<sup>(12)</sup>.

14% of males and 7% of females used commercially available anti-snoring devices because they learned about them through social media advertisements, and 24% of the population, whether used or not, believed that anti-snoring devices work in reducing snoring, while the rest did not.

Walker et al. used telephone and internet surveys to interview 1174 people in a population-based study in Canada to assess OSA awareness<sup>(13)</sup>. They reported that 56% of respondents were aware of the disease, with more than 60% able to list symptoms of OSA such as snoring or choking while sleeping. These respondents, however, were only eligible for the survey if they had risk factors for sleep apnea, with 58% reporting a history of snoring. One of the major causes of under-diagnosis is a lack of knowledge about this clinical entity among primary care and family physicians in general, who are the first point of contact between patients and healthcare facilities. Many cases are missed due to under-reporting of symptoms by patients or clinicians' ignorance of the appropriate screening for OSA in patients presenting with a variety of symptoms<sup>(9)</sup>.

A polysomnography reading is considered the "gold standard" for sleep disorder diagnosis. Sleep and wakefulness both cause physiological changes in various organ systems. A polysomnography documents the physiological function of these organ systems, as well as the qualitative and quantitative abnormalities of sleep and wakefulness, as well as the sleep-wake transition<sup>(14)</sup>.

Because of the high prevalence of OSA and the fact that patients frequently do not report sleep problems to clinicians, the review of systems should include asking about snoring, breathing pauses at night, and excessive fatigue or sleepiness during the day. Questionnaires available for assessing OSA risk include the Berlin Questionnaire<sup>(15)</sup>, developed for use in the primary care setting, and the STOP-Bang questionnaire<sup>(16)</sup>, developed for preoperative screening.

Kale SS, Kakodkar P, Shetiya SH. assessed the knowledge, attitude and practice regarding different domains of obstructive sleep apnea (OSA) amongst dentists from a dental college in India and concluded that Dentists showcased favorable attitude towards OSA, they possessed poor knowledge for domains concerning screening, diagnosis and treatment modalities of OSA which may be linked to the hurdle in their way of practice. Thus a special attention towards these domains needs to be given so as to improve the handling skills of dentist for OSA patients coming to their clinics and prevent further health related issues<sup>(17)</sup>.

Poor awareness of the disease among both the general public and healthcare professionals has contributed to the enormous public health burden of undiagnosed sleep apnea<sup>(18)</sup>. The findings provide information on the current state of OSA awareness in the community and highlight the fact that much more work needs to be done to improve public awareness and knowledge of OSA. Public health campaigns should be carried out to increase public awareness and to engage various media platforms in order to reach their target audience<sup>(19)</sup>.

Although there are known gender differences, there are only a few dedicated studies investigating the correlation of gender on the knowledge and clinical aspects of OSA.

The Obstructive Sleep Apnea and Attitudes Questionnaire (OSAKA) was created and validated for use in physicians<sup>(20)</sup>. We were unable to find a questionnaire similar to OSAKA that could be used in the general population, so we created our own survey questionnaire which was not validated. The baseline data discovered will be useful for comparing to future surveys to examine trends in OSA awareness. Finally, there is the possibility of response bias in this survey, as respondents may claim to be aware of the condition even if they have never heard of it in order to appear as "good subjects" who are knowledgeable. To some extent, we have attempted to mitigate this by following up our awareness questions with knowledge questions in which respondents are asked to define or list what they know about OSA. We believe that responses to the knowledge questions are an accurate reflection of what subjects in the community actually know about OSA.

## 5. Conclusion

The descriptive data suggests that the general population participated in the study showed a low level of awareness of all aspects of OSA.

- Though 58% of participants knew that a condition for snoring do exist the knowledge regarding symptoms, consequences, treatment modalities and Prosthodontic approach for treatment was absolutely low.
- Among 19.8% of the participants getting treated for sleep related issues and snoring only about 0.8% went to dentist.
- About 7.8% of the total participants choose the oral appliance therapy can be advantageous though none among the 400 participants underwent any appliance therapy to treat OSA.

This indicates the knowledge requirement regarding OSA among general population. OSA awareness should surely be focused on in dental curriculum along with treatment methods possible using prosthetic and surgical techniques. General population should be made aware of the role of dentist in treating OSA.

### Conflicts of interest

There's no conflict of interest

### Funding

Self funded study

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\* "All authors gave their final approval and agree to be accountable for all aspects of the work."

## Author Profile and Contribution

<sup>1</sup>Dr. Y. Ravi Shankar, Chair (Acred, Acad, and adms); Oral Implantology, Professor, Department of Prosthodontics; GITAM Dental College & Hospital.  
Mail id: [drravishankar22\[at\]gmail.com](mailto:drravishankar22[at]gmail.com)

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Ph no.: 9885307066

Contributed to conception, design, data acquisition and interpretation, drafted manuscript

<sup>2</sup> **Dr. Himabindu Vanipenta**, MDS, Department of Prosthodontics; GITAM Dental College & Hospital

Mail id: *himabinducm1111[at]gmail.com*

Ph no.: 9030888349

<sup>3</sup> **Dr. T. Satyendra Kumar** Associate Professor, Department of Prosthodontics; GITAM Dental College & Hospital

Mail id: *satya15292[at]gmail.com*

Ph no. :9490991243

Contributed to conception, design, interpretation, drafted and critically revised the manuscript

<sup>4</sup> **Dr. R. Himabindu**, Professor, Department of Prosthodontics, GITAM Dental College & Hospital

Mail id: *himabinduravella[at]gmail.com*

Ph no. : 8106658282

Contributed to design, data acquisition and critically revised the manuscript

<sup>5</sup> **Dr. K. Srinivas**, Head of the Department, Department of Prosthodontics, GITAM, Dental College & Hospital

Mail id: *srinivaskallurimds[at]gmail.com*

Ph no. : 9000815641

Contributed to data acquisition and interpretation, and critically revised the manuscript

<sup>6</sup> **Dr. B. Srinivas Rao**, Professor, Department of Prosthodontics, GITAM Dental College & Hospital

Mail id: *drsrinivasmds[at]gmail.com*

Ph no. : 9980477725

Contributed to analysis, drafted and critically revised the manuscript