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ORIGINAL ARTICLE

Investigation of Trends and Characteristics in Patients with Obstructive Sleep Apnea

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Background: *Oral appliance (OA) therapy for obstructive sleep apnea (OSA) has only been part of Japan's National Health care coverage plan since 2004. Subsequently, not enough time has passed to establish the medical trends and characteristics of OSA patients in Japanese Dental Hospitals.* ***Aim:*** *The aim of this study was to investigate the medical trends and the characteristics in patients with OSA who visited our clinic, and to compare our findings with previous studies.* ***Setting and design:*** *Epidemiological survey (retrospective study).* ***Materials and methods:*** *Two hundred and one patients were recruited at the Internal Medicine Division in the Tsurumi University Dental Hospital from February 2006 to December 2008, consecutively. Patients received a medical interview, and a detailed sleep analysis that included a polysomnography (PSG) to verify the exact nature of their condition. The efficacy of OA was assessed in 49 patients who wore an OA and underwent PSG.* ***Results:*** *Of all subjects, 141 patients visited the Prosthodontic Division to receive OA therapy, 38 patients were treated or received a follow up examination in the Internal Medicine Division. The dropout rate was 10.4% in the all subjects, 17.0% in patients who visited the Prosthodontic Division. The male-to-female ratio was 3.3:1, 3.0:1 in patients who visited the Prosthodontic Division. In addition, females had a lower rate of OAS severity than males. In our patients, the major complication was hypertension and cardiac disease. The success rate of OA was 75.5%.* ***Conclusion:*** *This approach allowed us to reveal some of the trends and characteristics in our patients.*

Keywords: Obstructive sleep apnea, Medical trend, Sex ratio, Age distribution, Systemic disease, BMI, Severity of OSA (AHI), Efficacy of oral appliance

Introduction

Sleep disordered breathing (SDB) is a well known and common syndrome [1–2]. It is associated with various medical problems [3–7] that have an impact on morbidity and mortality. Undiagnosed obstructive sleep apnea (OSA) is common in adults and is associated with cardiovascular and behavioral morbidity [8–10], although the severity spectrum is wide. Accordingly there have been many epidemiologic studies to establish the prevalence of SDB and OSA in Western countries [1, 2, 11–13], while limited data have been published in Asian countries [14–16].

Oral appliance (OA) therapy for OSA has only been part of Japanese National Healthcare coverage plan since 2004. Subsequently, not enough time has passed to establish the medical trends and characteristics of OSA patients in Japanese Dental Hospitals. The purpose of this study was to investigate the medical trends and the characteristics in patients with OSA who visited our snoring and OSA clinic, and to compare our findings with previous studies.

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Materials and Methods

Two hundred and one patients were recruited at the Internal Medicine Division of snoring and OSA clinic in Tsurumi University Dental Hospital from February 2006 to December 2008. Upon their first visit, patients received a medical interview, a detailed sleep analysis that included the Epworth's sleepiness scale (ESS) and a polysomnography (PSG) to verify the exact nature of their condition. Dependent upon the outcome of these tests, the patients were assigned for either nasal continuous positive airway pressure (nCPAP) or an OA treatment.

Severe OSA patients (apnea hypopnea index (AHI) ≧20) were persuaded to be treated with nCPAP in the Internal Medicine Division; mild and moderate OSA patients were persuaded to be treated with an OA in the Prosthodontic Division. Several patients with severe OSA needed a combination treatment with nCPAP and OA.

Of the 201 patients, 141 patients visited the Prosthodontic Division to receive an OA. The characteristics of these patients were investigated. Furthermore, the efficacy of OA was assessed in 49 OSA patients who wore an OA and underwent PSG.

The investigation focused on: clinical course of patients in our hospital, sex and age, systemic disease, body mass index (BMI), severity of OSA (AHI) and efficacy of OA.

Results

Clinical Course of Patients

Figure 1 shows the clinical course of OSA patients. Of 201 patients, 141 visited the Prosthodontic Division to receive OA therapy, 1 patient (0.5%) was referred to another hospital, and 21 patients (10.4%) dropped out prior to examination or during treatment in the Internal Medicine Division. The reasons for dropping out were, interruption of treatment (19 patients), and no desire for treatment (2 patients). Of 141 patients who visited Prothodontic Division, 110 patients started OA therapy, 1 patient (0.7%) was referred to another hospital, 6 (4.3%) patients needed to receive treatment for periodontal disease or dental cavities, and 24 (17.0%) patients dropped out. The reasons for dropping out were, interruption of treatment (23 patients), and no desire for treatment (1 patient). Two patients who had a remarkable retrognathia were referred to the oral surgery and orthodontic division to receive orthognathic surgery.

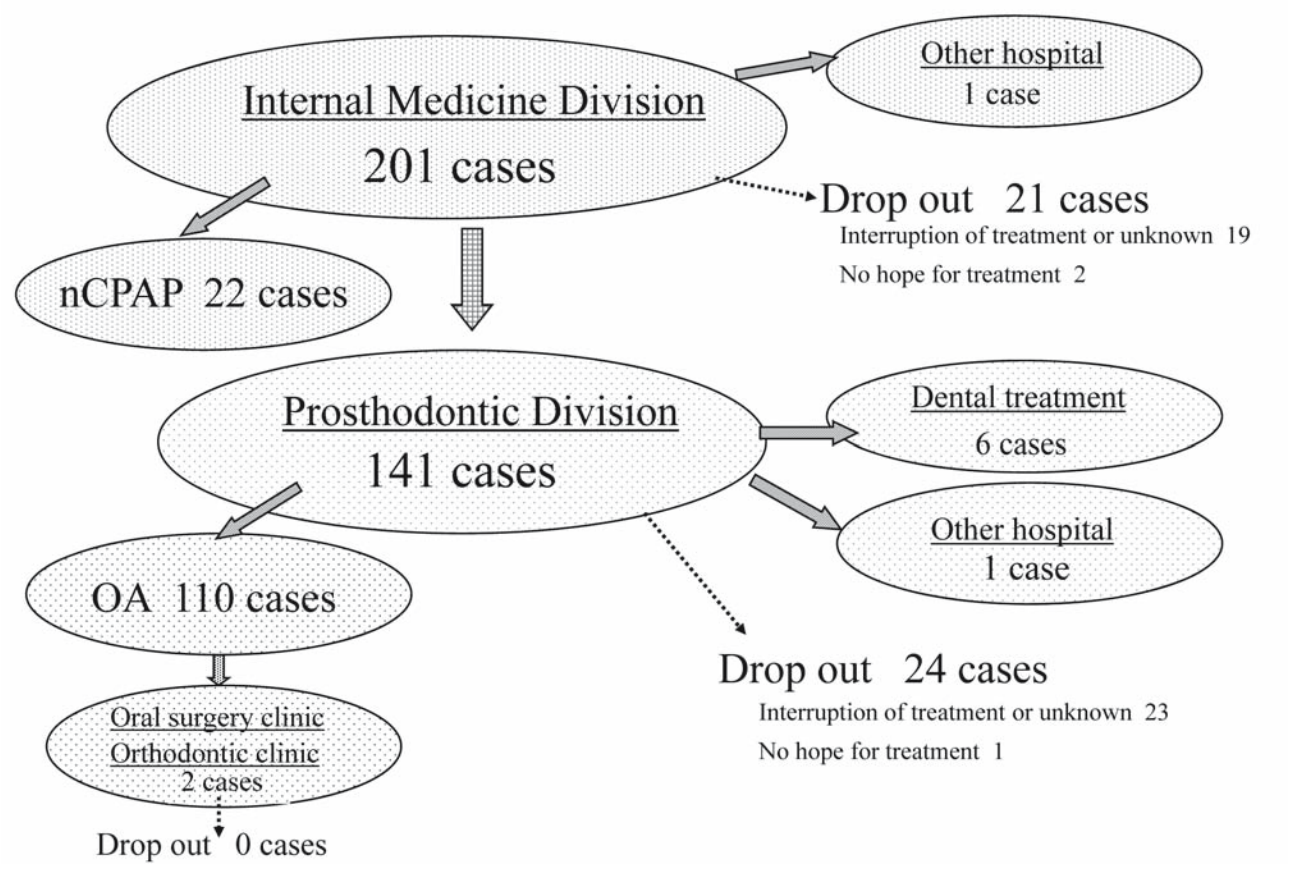

Fig. 1 Clinical course of the patients in Tsurumi University Dental Hospital

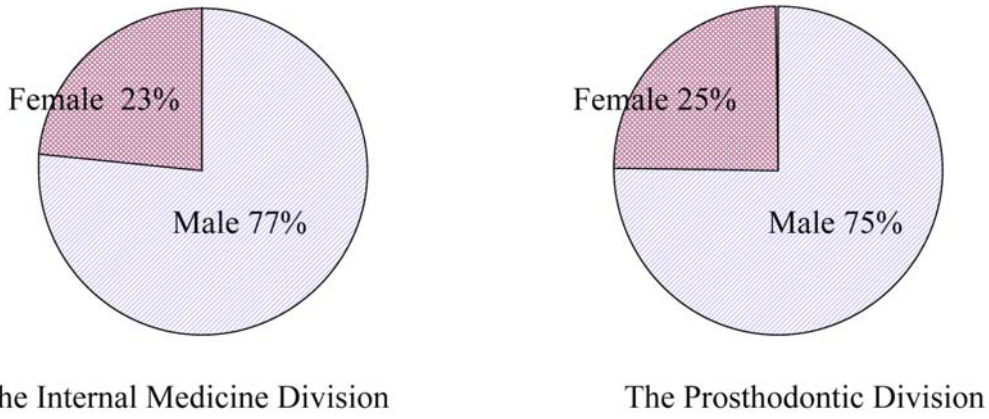

Fig. 2 The prevalence of male and female in each division

Sex Ratio and Age Distribution

The prevalence of OSA was higher in males than in females, male-to-female ratio was 3.3:1 (154:47) (Fig. 2). In the 141 patients who visited the Prosthodontic Division, the prevalence of OSA was higher in males than in females, and male-to-female ratio was 3.0:1 (106:35) (Fig. 2).

The age of all patients ranged from 16 to 86 years, with an average age of 51.0 ± 14.6 years [males: from 19 to 86 (50.3 ± 14.4) years, females: from 16 to 77 (53.5 ± 15.3) years) In the 141 patients who visited the Prosthodontic Division, the age ranged from 24 to 86 years with an average age of 52.4 ± 13.8 years (males: from 25 to 86 (52.4 ± 13.7) years, females: from 24 to 77 (52.7 ± 14.2) years]. There was no significant difference between the groups (t-test: p = 0.371). Figure 3 shows the age distribution of OSA patients. The majority were in their forties (44 patients [21.9%]), followed by the patients in their thirties and fifties (42 patients for each group [each accounting for 20.9 %]).

Systemic Disease

34.3% (69/201) of the patients had hypertension, 10.0% (20/201) of the patients had cardiac disease, and 11.4% (23/201) of the patients had dyslipidemia (Table 1).

Table 1 Underlying systemic disease in patients with OSA

Underlying disease	No. of Subjects	%
Hypertansion	69	34.3
Allergy	45	22.4
Dyslipidemia	23	11.4
Cardiac disease	20	10.0
Cancer	9	4.5
Nasulseptum	9	4.5
Diabetes mellitus	9	4.5
Hyperuricemia	8	4.0
Hepatic disease	5	2.5
Thyroid disease	5	2.5
Depression	5	2.5
Gyniatrics disease	5	2.5
Cerebrovascular disease	2	1.0
Others	67	33.3

BMI

The BMI of all patients (200/201) ranged from 15.1 to 42.5 kg/m^2, with an average BMI of 24.5±4.1 kg/m^2 [males: from 19.8 to 42.5 (25.1 ± 3.8) kg/m^2, females (46/47): from 15.1 to 35.8 (22.5 ± 4.3) kg/m^2]. In the 141 patients who visited the Prosthodontic Division, the BMI ranged from 15.1 to 35.8 kg/m^2 with an average BMI of 24.2 ± 3.4 kg/m^2 [males: from 20.6 to 35.8 (24.7±3.0) kg/m^2, females: from 15.1 to 35.8 (22.7±4.2) kg/m^2]. There was no significant difference between the groups (t-test: p = 0.463). The patients were divided into 3 groups (thin, normal and obese) according to BMI. Six patients were categorized as thin (3%), 123 patients as normal (61.5%), 71 patients as obese (35.5%) (Fig. 4). In the 141 patients who visited the Prosthodontic Division, 3 patients were categorized as thin (2.1%), 92 patients as normal (65.2%), and 46 patients as obese (32.6%) (Fig. 4).

Severity of OSA

The AHI of all patients (199/201) ranged from 0 to 116.8 events/hour, with an average AHI of 27.5 ± 24.7 events/hour [males (152/154): from 0.3 to 116.8 (30.8 ± 25.3

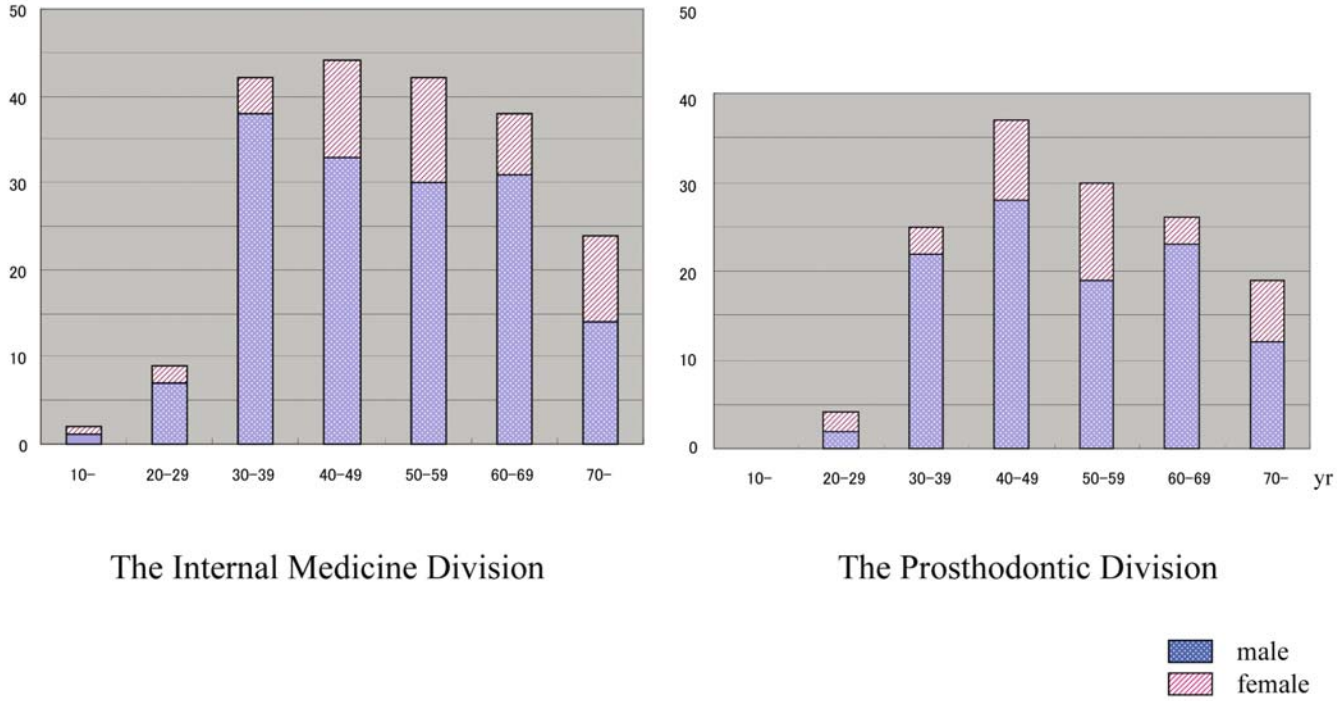

Fig. 3 Age distribution of male and female patients seen in the Tsurumi. University Dental Hospital from February 2006 to December 2008

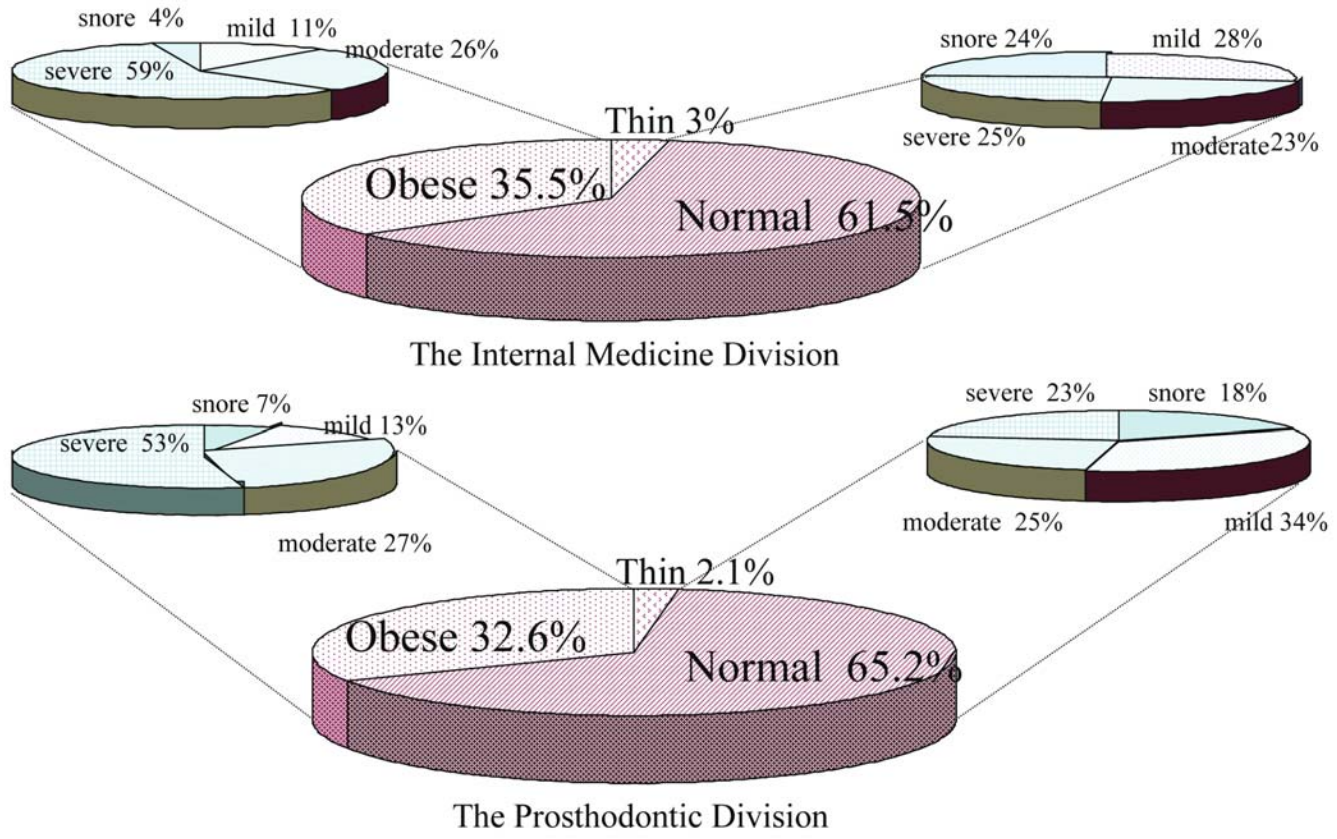

Fig. 4 Relation between body mass index (BMI) classification and the apnea/hypopnea index (AHI) classification

events/hour, females: from 0 to 71.1 (16.9 ± 19.3) events/hour]. In the 141 patients who visited the Prosthodontic Division, the AHI ranged from 0 to 116.8 events/hour with an average AHI of 25.5±22.3 events/hour [males: from 0.7 to 116.8 (28.0 ± 22.3) events/hour, females: from 0 to 71.1 (17.7 ± 20.75) events/hour]. There was no significant difference between the groups (t-test: $p = 0.428$). The patients were divided into 4 groups (primary snorer, mild, moderate and severe) by AHI. Figure 5 shows the severity of OSA in the Internal Medicine and the Prosthodontic Division. Of all patients, 37 patients were categorized as primary snorers (18.6%), 41 patients as mild (20.6%), 48 patients as moderate (24.1%), and 73 patients as severe (36.7%). In the 141 patients who visited the Prosthodontic Division, 22 patients were categorized as primary snorers (15.6%), 37 patients as mild (26.2%), 35 patients as moderate (24.8%), and 47 patients as severe (33.3%).

Table 2 shows the severity of OSA patients by sex. Females had a lower severity than males (t-test: $p < 0.001$)

Efficacy of OA

In 49 patients, the efficacy of OA was assessed with PSG. The patients were divided into 2 groups based on their response to OA in terms of AHI. Patients were categorized as responder when their AHI was <5 events/hour, and/or when their AHI decreased to <50% of the baseline after OA treatment. Thrity-seven patients (75.5%) responded and 12 patients (24.5%) didn't respond.

Discussion

Clinical Course of Patients

To observe medical trends, we investigated characteristics of the patients who visited the Prosthodontic Division to receive OA therapy, and reviewed the following points while comparing both groups.

Sex Ratio and Age Distribution

In the present study, male-to-female ratio was 3.3:1. In 2007, Lam et al. [17] reviewed the prevalence of OSA in Asia, and reported the overall male-to-female ratio with symptomatic OSA was 2:1, and the ratio was dependent on the severity of OSA; 1.3:1 in the group with mild OSA (AHI 5–15), and 9:1 in the group with severe OSA (AHI ≧ 30), despite a comparable BMI in men and women with OSA. OSA prevalence in males was higher than in previous studies.

The age distribution of 5,000 men and 1,000 women with OSA was studied at the Technion Sleep Disorder Center [18]. There is a progressive increase in the prevalence of OSA, up to the sixth or seventh decade of life, independent of BMI. On the other hand, in this present study, the prevalence of OSA increased from the thirties.

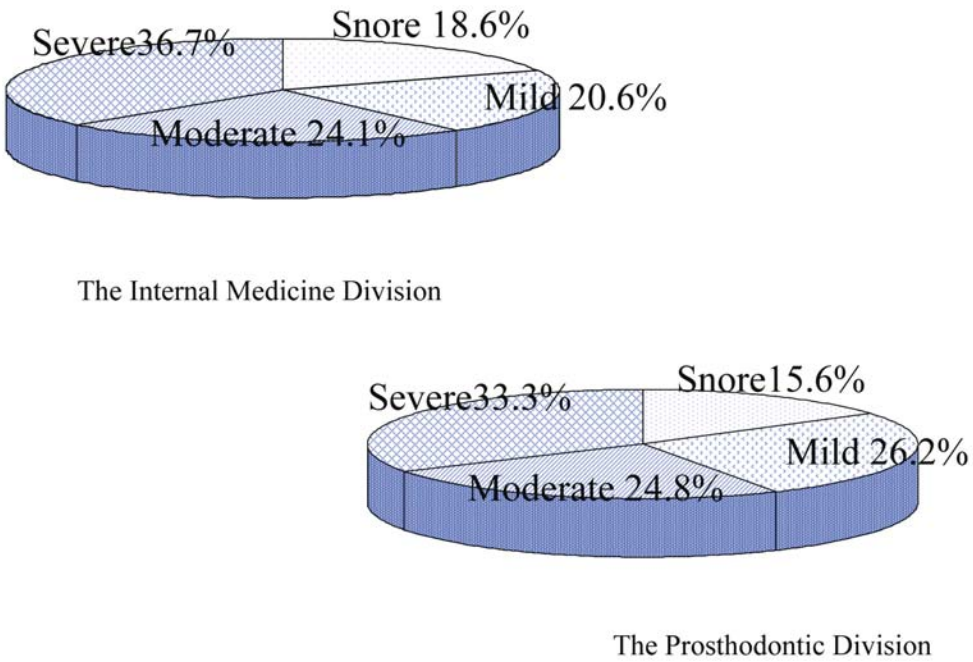

Fig. 5 Comparison between the Internal Medicine Division and the Prosthodontic Division. Patients by apnea/hypopnea (AHI) classification

Table 2 The severity of OSA patients by gender

		Total number	male (mean ± SD)	Female (mean ± SD)
Snore	IM	37	19 (2.79 ± 1.37)	18 (2.22 ± 1.29)
	P	22	9 (3.03 ± 1.52)	13 (2.29 ± 1.47)
Mild	IM	41	30 (9.34 ± 2.73)	11 (9.15 ± 2.51)
	P	37	27 (9.61 ± 2.67)	10 (9.07 ± 2.63)
Moderate	IM	48	40 (21.51 ± 3.98)	8 (18.98 ± 3.14)
	P	35	31 (21.59 ± 4.01)	4 (20.50 ± 3.02)
Severe	IM	73	63 (55.45 ± 20.23)	10 (50.04 ± 12.70)
	P	47	39 (51.63 ± 19.19)	8 (52.18 ± 12.81)

IM: Internal Medicine Division (N = 199), P: Prosthodontic Division (N = 141)

Systemic disease

In our subjects, the major complications were hypertension and cardiac disease. Since, both sleep apnea and hypertension were common, many individuals supposed to have both conditions. However, recent study revealed that both are closely linked to obesity, as well as to diabetes and metabolic syndrome. The previous studies reported that about 60% of sleep apnea patients are hypertensive [19], and conversely, about 30% of hypertensive patients have sleep apnea [20–23], according to the Wisconsin Sleep Cohort Study [24–25]. In 2007, Parish et al. [26] compared the prevalence of metabolic syndrome, hypertension, diabetes and dyslipidemia in OSA patient that in the group without OSA. Patients with OSA have a high prevalence of metabolic syndrome. The prevalence of the patients who have both metabolic syndrome and hypertension was significantly greater in the OSA group. No significant differences were noted between the 2 groups in proportion to the patients with diabetes and dyslipidemia.

According to the National Health and Nutrition Examination Survey by the Ministry of Health, Labour and Welfare [27], the number of people in Japan with hypertension or dyslipidemia was estimated to be at 54,900,000 and 14,100,000, respectively. Thus, 45% of the nation has hypertension. In our subjects, 34.3% patients had hypertension as a complication with OSA, and the prevalence was lower than in the rest of the nation. On the other hand, our results of the prevalence of dyslipidemia in OSA patient corresponded with Parish et al. report.

BMI

Obesity and craniofacial profiles are two established risk factors for the development of OSA. However, obesity is less common among Asians. Consistent to this, the majority of patients were categorized as normal BMI in this study. In addition, the reported value of BMIs of Asian OSA patients is lower than in their Caucasian counterparts [28]. Thus, craniofacial structural features could be a prominent contributing factor towards the development of OSA in Asians [29].

Severity of OSA

In 2004, Ip et al. [29] investigated the prevalence of OSA in middle-aged Chinese women, and compared with the prevalence of OSA in men reported in a similar study. They reported that, compared to males, females had a lower severity of SDB. Our results corresponded with their findings (Table 2).

Efficacy of OA

In 2004, Tsuiki et al. investigated the effects of mandibular advancement in 20 OSA patients [30]. They reported that in all 20 patients, both the mean apnea AHI before treatment were significantly reduced after titration of the mandibular position (31.6 ± 13.0 to 9.8 ± 7.4 events/hour, $p < 0.001$. On the basis of the post-titration AHI values, the 20 patients were divided into good responders (n = 14) where the AHI was reduced to ≦15 events/hour and poor responders (n = 6) where the AHI was reduced to >15 events/hour. Thus their rate of success was 70%. In this present study, the rate of success was 75.5%. The efficacy of OA was estimated between 70 and 75%.

Conclusion

We investigated the medical trends and the characteristics in patients with OSA who visited our snoring and OSA clinic, and compared our findings with previous

studies. This approach allowed us to reveal some of the trends and characteristics in our patients. There are few epidemiologic studies about OSA, especially in the dental field. Our findings might prove useful to future studies.

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