Evaluation of Oxygen Saturation by Pulse-Oximetry in Mouth Breathing Patients

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Abstract- Mouth breathing might not always result in hypoxia, but can contribute to it. The aim of the present study was to determine the effect of mouth breathing on hypoxia. Based on a pilot study, 323 patients with mouth breathing were selected. Assessment of mouth breathing was based on clinical examination and questionnaires filled out by patients and their companions. The patients were also examined for further oral findings that could be attributable to mouth breathing. Oxygen saturation of each case was measured by means of a pulse oximetry device. The level of 95% saturation was set as the limit, under which the patient was considered hypoxemic. Acquired data was analyzed for descriptive data and frequency and also by means of the Chi-square and Spearman's correlation coefficient tests. 34.6% of the cases had normal O_2 saturation. 65.4% of cases were hypoxemic (saturation level was below 95% in 42.8% and 95% in 22.6%). Most of the mouth breathing patients were male who were also more hypoxemic. A weak inverse relationship existed between the age of the patients and Oxygen saturation. Deep palatal vaults (29.4%) and gingival hyperplasia (29.2%) were the most frequent intraoral findings. Concerning the effects of hypoxia on body systems, the use of pulse oximetry in suspected mouth breathing patients could be recommended in routine oral and dental examinations.

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Introduction

Hypoxia is a situation that can occur in polycythemia and resultant pulmonary hypertension (1). The main reason for hypoxia is not clear at present and possible causes have been proposed. In fact, the imbalance between blood gases is multifactorial and not totally understood yet (2).

Obstructive problems of the respiratory tract have been considered as an entity that could lead to hypoxia. Examples such as obesity, nasal obstruction, snoring and apnea intensify the upper airway resistance and could end in consequences such as hypoxia (3-5).

Mouth breathing is a situation that has been related to hypoxia (6). The term mouth breathing is not always an appropriate term. In most conditions, there is a combination of oral and nasal breathing (7). In fact, more than 60% of the so-called mouth breathers have a combination of oral and nasal breathing and only 4.3% are truly mouth breathers (8).

Hypoxia may be left undetected in preliminary examinations, and analysis of the patients' blood gases would be necessary. The routine method for evaluating arterial blood gases is invasive, expensive and also time consuming. Application of pulse oximetry devices could be an acceptable and easy way for screening and diagnosing hypoxic patients.

Considering the aforementioned importance of hypoxia, our purpose was to determine the amount of Oxygen saturation in patients with mouth breathing to decrease the negative consequences of hypoxia in such patients.

Patients and Methods

This research was designed as a cross-sectional study. All study cases were mouth-breathing patients referring to the ENT department of Amir Aalam hospital in 2005.

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Table 1. Age and gender distribution of the study cases

Sex	Male		Female		Male and Female	
Age	number	Percent	number	Percent	number	Percent
<10	51	27.1	16.0	11.9	67	20.7
10-20	43	22.9	22.0	16.3	65	20.1
20-30	31	16.5	41.0	30.4	72	22.3
30-40	32	17.0	17.0	12.6	49	15.2
40-50	17	9.0	21.0	15.6	38	11.8
50-60	11	5.9	15.0	11.1	26	8
60-70	2	1.1	1.0	0.7	3	0.9
70-80	0	0	2.0	1.5	2	0.6
>80	1	0.5	0	0	1	0.3
Total	188	100.0	135	100	323	100

Based on a pilot study to determine sample size, a number of 323 patients were selected for this study. Assessment of mouth breathing was based on both clinical examination and questionnaires filled out by patients and their companions. The questions mainly dealt with possible signs of airway obstruction; open lips during sleep, snoring, sleep apnea, etc. The patients were also examined for further oral findings that could be attributable to mouth breathing. In the next step, SPO2 saturation for every patient was recorded. A portable pulse-oximetry device (Oxipen®, EnviteC-Wismar, Germany) was used in this study as a substitute to arterial blood sampling. After connecting the optical diodes on patients' fingers, SPO2 value of each patient was recorded as the percentage of hemoglobin oxygen saturation (9). The 95% saturation level was set as a limit, therefore lower values were interpreted as hypoxemic. The test was carried out 3 times for each patient and the average accepted as the SPO2. Along with descriptive statistics, acquired data was analyzed by means of the Chi-square and Spearman's correlation coefficient tests.

Results

The age and gender distribution of the patients are shown in table 1. Based on the SPO2 evaluations, 65.4% of the study cases were considered hypoxemic, while 34.6% had normal O2 saturation. Considering gender, 31.4% of mouth breathing males and 40% of mouth breathing females had normal O2 saturation.

Males were more hypoxemic (men: 68.6%, females: 60.1%) and comprised 52.8% of the mouth breathing cases. In addition, most of the hypoxemic cases (13%), showed O2 saturation between 92-94%. There was a weak and inverse correlation between age and SPO2 values. Based on Chi-square test, there was no reliable correlation between apnea and SPO2 values, and also no correlation between and SPO2 values.

Among the oral findings of this study, deep palatal vaults and gingival hyperplasia were the most common (Table 2).

Table 2. Frequency of intraoral findings among study cases

Intraoral finding	Frequency	Percent	Valid Percent	Cumulative percent
Post cross bite	93	20.4	22.5	22.5
Deep palate	134	29.4	32.4	55
Gingival hyperplasia	133	29.2	32.2	87.2
Anterior openbite	53	11.6	12.8	100
Missing cases	43	9.4		
Total	456	100	100	

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Discussion

Hypoxia resulting from nasal obstruction has been studied in different ways. Nasal packs after septoplasty have shown that the average PaO_2 significantly decreased two nights after the surgery (10), but if there was an airway through the pack for making the airway open, there was no significant difference in PaO_2 and PCO_2 before and after the surgery. Another study carried out by Yadav et al. shows that after adenotonsillar surgery in children, an increase in O_2 saturation values and spirometric factors were observed (11). Nadapalon et al. found out that apnea induced hypoxia after adenotonsilectomy in children with congenital cardiac problems (12). Bilateral nasal obstruction also causes a decrease of PO_2 and an increase of PCO_2 in arterial blood (13).

Mouth breathing could be an outcome of nasal obstruction; therefore, any sign of such situation must be considered in order to detect its underlying cause. Regarding the results of this study, mouth breathing patients could have a relatively high chance of being hypoxemic and attempts to improve nasal breathing could be beneficial.

The important point of the present study is that in addition to ease of evaluating O_2 saturation by pulse oximetry in patients with mouth breathing, and in regard to the relative ease of mouth breathing treatment and elimination of specific types of airway obstruction in orthodontic treatments by means of Rapid Maxillary Expansion (RME), it would be helpful to use pulse oximetry in routine dental inspections.

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