



Nasal Cycle Pattern Can Transform Into Another Form Over Time

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ABSTRACT

The nasal cycle is a physiologic phenomenon which is affected by some internal and external agents. This study aimed to determine the changes of nasal cycle in healthy subjects over time. The measurements of nasal cycle were made by using a rhinomanometer during 6 h with 30 min intervals in a total of 18 healthy volunteers. The measurements were repeated after 3 months to detect the alteration of nasal resistance over time. The results for the left and right nostril plotted graphically and then patterns of fluctuation in nasal patency were divided into the four categories as mentioned before in literature. We detected a classic pattern of nasal cycle in 6 of 18 healthy volunteers, noncyclic nose in two individuals and irregular pattern in 10 of them in first rhinomanometry measurements. In second measurements after 3 months, seven subjects exhibited different pattern from that in first examination. One participant who had noncyclic nose 3 months ago transformed to irregular pattern and two subjects present noncyclic nose which showed irregular pattern in first measurements. We strikingly detected the changes in the types and presence of nasal cycles over time and suggested that nasal cycle measurements should be made in extended time intervals.

Key words: Nasal cycle, nasal airflow, anterior rhinomanometry, rhinomanometer

Nasal Siklus Paterni Zamanla bir Diğer Forma Dönüşebilir

ÖZET

Nazal siklus, bazı iç ve dış ajanlardan etkilenen fizyolojik bir olaydır. Bu çalışma sağlıklı bireylerde nazal siklusun zamanla değişimini ortaya koymayı amaçlamaktadır. Nazal siklus ölçümleri bir rinomanometre kullanılarak toplam 18 sağlıklı gönüllüde 6 saat süresince 30 dk aralıklarla yapıldı. Nazal siklusun zamanla değişimini tespit etmek için, ölçümler üç ay sonra tekrar edildi. Sol ve sağ nostrilden yapılan ölçüm sonuçları grafik olarak çizildi ve nazal mukozanın fluktuasyon paterni, literatürde verilen şekli ile dört tipe ayrıldı. İlk rinomanometrik ölçümlerde, çalışmaya katılan 18 sağlıklı gönüllüden 6'sında klasik paternde nazal siklus, 2 bireyde non-siklik burun ve 10 bireyde irregüler tip nazal siklus tespit ettik. Üç ay sonra yapılan ikinci ölçümlerde, 7 gönüllü ilk muayeneden farklı tipte nazal siklus sergiledi. Üç ay önce non-siklik burun tespit edilen bir katılımcı irregüler paterne değişim göstermişti ve ilk ölçümlerde irregüler patern gösteren iki bireyde non-siklik burun ortaya çıkmıştı. Nazal siklusun uzun zaman aralığında farklı siklus paternine dönüşebileceğini tespit ettik. Nazal siklus çalışmalarında bu durumun göz önünde bulundurulması uygun olacaktır.

Anahtar kelimeler: Nazal siklus, nazal havaakımı, anterior rinomanometri, rinomanometre

INTRODUCTION

The nasal cycle is a physiologic phenomenon that may cause a periodic change of the nasal airway patency. The spontaneous alteration in congestion and decongestion of the nasal mucosa especially in inferior turbinates forms nasal cycle. The “working phase” of the nasal cycle is

characterized by decongestion of the cavernous tissues of the nasal mucosa while the “resting phase” is characterized by congestion of it (1,2). Although it has been known since one hundred years, the regulative mechanisms and pattern of the nasal cycle in normal and pathologic conditions haven't been revealed completely. In the ideal cycle, the left and right sides of the nose have identi-

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cal periods between 30 min and 6 h but 180 degrees out of phase (3). Although there are some changes in mean airflow, resistance, and volume, total nasal airflow is constant in a normal condition.

There are certain methods and instruments which have been used to detect the nasal cycle; rhinoscopy, congestion scoring, mirror fog tests, optical instruments, magnetic resonance imaging, acoustic rhinometry, rhinoresistometry, and rhinomanometry (RMM) (1,3-5). Rhinomanometry is a well-established technique used for measurement of nasal patency in terms of nasal airflow and resistance to airflow (6). In addition, it has been standardized as a functional test extending to describe the nasal cycle (7). In the studies using different methods, nasal cycle has been reported in 13% to 80% of adults. Four types of nasal cycles was defined: 1- classic type; reciprocal congestion/decongestion alterations, total volume is constant; 2- parallel type; congestion or decongestion appear in both nasal cavities at the same time; 3- irregular type; mutual alteration in nasal volume without a defined pattern; 4- no cycle; there isn't any significant changes in nasal air fluctuation (8,9).

In this study, we aimed to investigate nasal cycle by using rhinomanometric measurements at intervals of 30 min for 6 h and to show alteration of nasal cycle over time. Measurements were repeated after three months.

MATERIALS AND METHODS

Study Subjects

A total of 18 healthy subjects (7 males and 11 females) were included in this study. All the provided subjects had a written and informed consent before being included in the study and it was taken from an Ethic Committee permission document of the Ataturk University. Subjects with septal deformities, nasal polyps or tumor, allergic rhinitis, recent or recurrent respiratory tract infection, use of nasal or systemic medication, nasal surgery, nasal radiotherapy, and with any systemic disorder were excluded. At first, all patients were examined by anterior rhinoscopy and nasal endoscopy.

Study Design

In all subjects anterior rhinomanometry was performed for the first time and three months later (two times). After inclusion in the study, participants were told the importance of measurement time and asked to be pres-

ent in the measurement room at 08.30 am. It was allowed to rest for 30 min prior to any measurement. All measurements of nasal cycle were begun at 09.00 am in the room temperature and taken 6 h with 30 min intervals using a rhinomanometer (NR6 model, Mercury Electronics). Nasal airflow measurements were made by using the technique of anterior RMM with silastic nose-pieces. For each nasal passage, three consecutive series of four measurements were made by using an inspiratory reference pressure of 150 Pa. The volunteers were confined to the study area and were not allowed to lie supine or sleep during the measurements.

The results for the left and right nostril for each parameter were plotted graphically to assess whether a true alternating cycle existed for each patient. Patterns of fluctuation in nasal patency were divided into the following categories as mentioned before in literature:

-Classic pattern; congestion in one side was followed by decongestion in the other side, but the total volume was constant.

-Parallel pattern; congestion and decongestion were simultaneously seen in both nostrils.

-Irregular pattern; there wasn't a regular pattern and total nasal volume alter.

-No pattern; total nasal volume and nasal volume in each nostril don't differ.

RESULTS

In this study, we detected, as agree with literature, a classic pattern nasal cycle in 6 of 18 healthy volunteers and irregular pattern in 10 of them in first RMM measurements during 6 h with 30 min intervals. We couldn't determine parallel pattern any subject but noncyclic nose in two individuals (Table 1). In second measurements after 3 months, three subjects who exhibited irregular pattern in first examination present the regular pattern and a subject who exhibited classic pattern in first examination changed to irregular pattern (subject E are showed in figure2a and 2b). One of two participants who had noncyclic nose 3 months ago transformed to irregular pattern (subject R are showed in figure 1a and 1b). In addition, we didn't detect nasal cycle in two subjects who showed irregular pattern in first measurements. The other participants kept the same pattern.

Table 1. Nasal cycle patterns of healthy subjects in first and second measurements.

Subject	Age (year)	Sex	Nasal cycle pattern	
			First measurement	Second measurement
A	23	F	Classic pattern	Classic pattern
B	42	F	Classic pattern	Classic pattern
C	37	M	Classic pattern	Classic pattern
D	34	M	Classic pattern	Classic pattern
E	37	F	Classic pattern	Irregular pattern
F	19	F	Classic pattern	Classic pattern
G	48	M	Irregular pattern	Irregular pattern
H	42	F	Irregular pattern	Classic pattern
I	29	M	Irregular pattern	Irregular pattern
K	33	F	Irregular pattern	Noncyclic nose
L	25	F	Irregular pattern	Irregular pattern
M	22	M	Irregular pattern	Classic pattern
N	30	F	Irregular pattern	Classic pattern
O	33	F	Irregular pattern	Irregular pattern
P	45	F	Irregular pattern	Irregular pattern
Q	22	M	Irregular pattern	Noncyclic nose
R	38	M	Noncyclic nose	Irregular pattern
S	34	F	Noncyclic nose	Noncyclic nose

DISCUSSION

The presence of the nasal cycle has been shown by using different methods in many studies since it was firstly described (1, 3-5). Rhinomanometry is considered to be gold standard for objective measurement of nasal airflow (6). We choose RMM as the means to evaluate the presence or absence of a nasal cycle in the healthy subjects because it is a rapid, reproducible, painless and non-invasive technique. In those measurements which were performed with three months interval, we strikingly detected the changes in the types and presence

of nasal cycles in some subjects. This observation suggested that nasal cycle may be unstable.

In the literature; there are many descriptions of the spontaneous and generally reciprocal changes in nasal airflow usually referred as “nasal cycle”. In various studies using different methods, nasal cycle has been reported in 13% to 80% of adults (2,9). Heetderks reported a definite cycle of reaction in 80% of 60 healthy volunteers (2). There are many studies in the literature supporting the idea that 80% of the population exhibits a phenomenon called nasal cycle (2,10). However, some

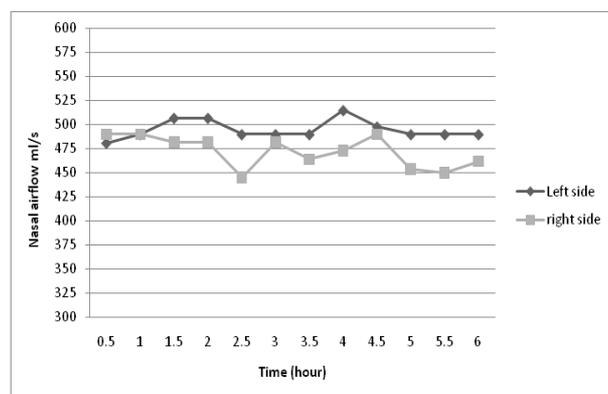


Figure 1a. The results of the first measurements in subject R who had noncyclic nose.

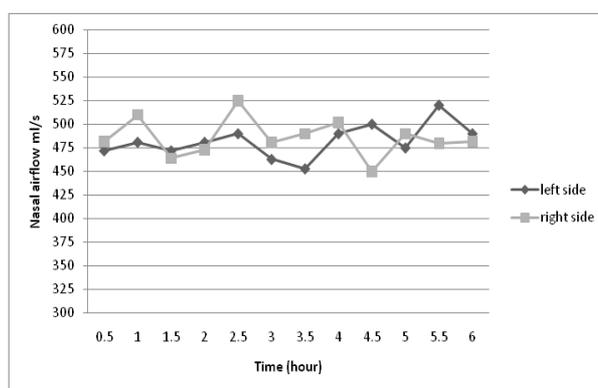


Figure 1b. The results of the second measurements in subject R who had irregular cyclic pattern.

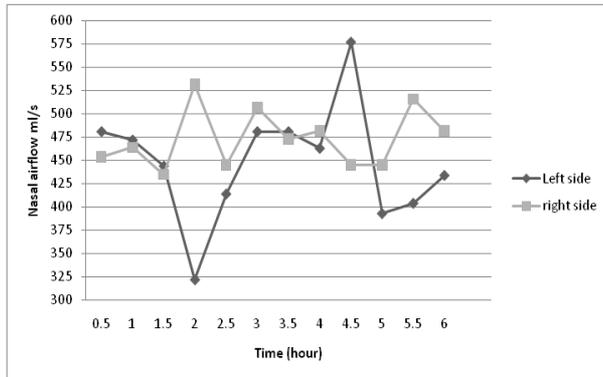


Figure 2a. The results of the first measurements in the subject E who had classic nasal cycle.

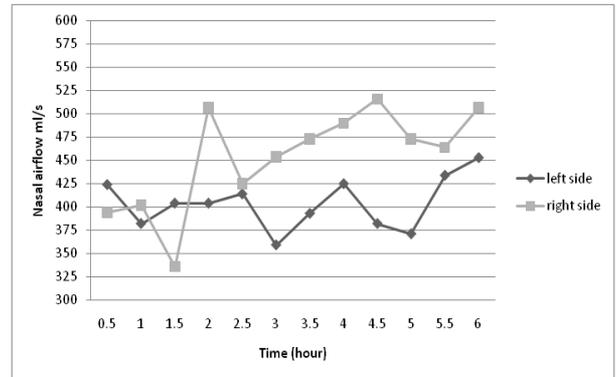


Figure 2b. The results of the second measurements in the subject E who had irregular pattern of nasal cycle.

studies researching the reciprocity of nasal airflow, reported a lower range varying from 21% to 39%. Tahamiler et al. reported a cyclic nasal airflow change in only 21% of 52 volunteers (11). Gilbert showed bilateral rhythmicity in only 2 of 16 healthy subjects and bilateral reciprocity in 7 out of 16 volunteers by using autocorrelation as a measure of rhythmicity (9). One reason of this discrepancy in the literature is that the most studies have relied on simple observations to evaluate the changes in nasal resistance and haven't submitted any quantitative parameter to quantify the changes in resistance. Another reason is the different typing of cyclic nose. Some researchers approved that any variation in the airflow implicates the presence of nasal cycle and divided it into four groups. Other researchers proposed that non-reciprocal variations are called as "non-cyclic nose" whereas normal nasal cycle is characterized by reciprocal variations. Kern used the "non-cycle nose" term for non-fluctuating or non-rhythmic fluctuating nasal airflow and defined three different types of the non-cyclic nose; type 1, there isn't any significant fluctuation; type 2, significant fluctuations in only one side; and type 3, non reciprocal fluctuations in both sides (12). The accepted opinion of the present day is that about 80% of the healthy population has a regular nasal cycle. The duration of the cycle ranges from 30 min to 6 h. In practice, however, there is a wide variation in nasal volume, airflow and patency change, with and without reciprocal changes in the opposite nasal cavity (3). In our study, we couldn't detect any significant fluctuation termed as "non-cyclic nose" in 2 of 18 subjects in first examination and in 3 of 18 subjects in second examination.

This result agrees with 80% reported rate in the literature. Two subjects in first measurement and three subjects in second measurement exhibited different types of nasal cycles. There are few specific reports, which clearly indicate the changes of nasal cycle on time. In studies related to nasal cycles, the measurements had been done usually around 6 or 8 hours and nasal cycle was not evaluated daily, weekly or monthly. In the study performed by Tahamiler et al. nasal cycle was investigated at every 30 minutes over a period of 12 hours on 4 different days in the same week and measured at 96 times for each subject. They used the Odiosoft-Rhino (OR) software program and detected nasal cycles in all healthy volunteers at different days (11). In the second study, Kern reported that any individual is not confined to a specific type of non-cycle nose as measurements were performed some months apart on one subject who manifested two different 'types' at the different points in time. Of the 50 subjects, 14 didn't have evidence of a normal nasal cycle (12).

It has been proposed that nasal cycle is regulated by the hypothalamus with the sympathetic nervous system exerting a significant influence on it (13). Nasal resistance is also influenced by some factors including hyperventilation, supine posture, cold air, infective, allergic and vasomotor rhinitis as well as drugs such as aspirin and sympathetic antagonists (14,15). The resistance is decreased by exercise, erect posture, rebreathing expired air, atrophic rhinitis and sympathomimetic drugs (16,17).

In this study differing from the literature, we repeated

the measurements after 3 months from initial evaluation. Therefore, we could detect alterations in the nasal cycle over time in certain subjects. We have also shown that some subjects, who didn't have any nasal airflow fluctuation in first measurement, had nasal resistance in measurement performed 3 months later. In the literature, studies on the nasal cycle performed in healthy subjects, had been done within a day and certain time span. By this point of view, our study is contributing to the literature by establishing the long term alterations in the nasal cycle. The study has shown that nasal cycle patterns of the subjects may transform from one another. On the other hand, subjects showing non-cyclic pattern, can be detected nasal cycle on time. This can be due to the nasal cycle which is under control of the hypothalamus, could be affected by the environmental factors or occurrence of cyclic alterations in nasal cycle could be more than 6 h of time span.

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