

Clinical evaluation of the nasal dilator Nozovent. The effect on snoring and dryness of the mouth.

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SUMMARY

When the lateral walls of the nostrils are dilated with Nozovent, inhalation requires less force, thus reducing the risk of vibrations of the soft palate creating the snoring sound. There is also less need for mouth-breathing. When 17 patients were tested during 10 nights, every second night using Nozovent, the sleeping partners noted significantly less snoring these nights than during the nights without Nozovent. The patients themselves also noted significantly less dryness of the mouth when they dilated the nostrils with Nozovent, being able to avoid mouth-breathing.

INTRODUCTION

The nostrils are the narrowest part of the air passage to the lungs, accounting for more than half of the airway resistance during nasal breathing (Bachman and Legler, 1972). With acoustic rhinometry the mean value of the cross-sectional area in the isthmus nasi on one side has been calculated to be 0.7 cm² and in the bony opening of the noses to be circa 1 cm² (Lenders and Pirsig, 1990). The cross-sectional areas for both sides are thus 1.4 cm² and 2 cm², respectively. When the nostrils are dilated with the medical device Nozovent, the bony opening of the nose becomes the narrowest part of the nose, as all soft tissues in the nasal wings are pushed aside by the dilator (Petruson, 1990).

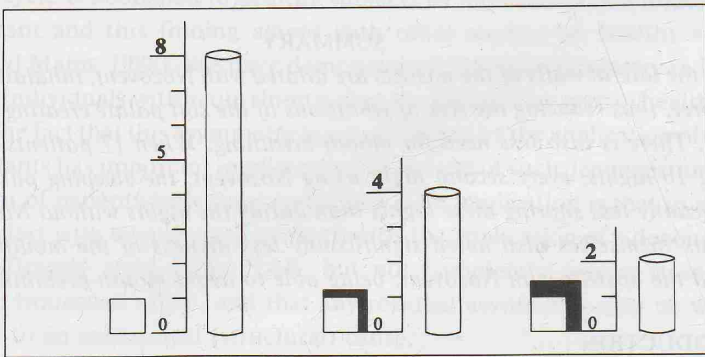
Using Poiseuille's law for laminar airflow the correlation between the narrowest cross-sectional area in the nose and the negative intrathoracic pressure during inspiration can be calculated. If the cross-sectional area increases from 1.4 to 2 cm², the fourth power of the diameter increases from 2 to 4, and the pressure drop can be reduced to half; from, in average, 4 to 2 cm H₂O (Figure 1). In other words, when the nostrils are dilated with Nozovent one can inspire the same amount of air at the same time, with a negative intrathoracic pressure only half of the normal. This also means that less energy is needed for the respiratory muscles during inspiration.

Poiseuille's Law

$$\Delta p = \frac{1}{d^4} \quad (\text{Laminar flow})$$

$$\frac{1}{d^5} \quad (\text{Turbulent flow})$$

area (cm ²)	1	1.4	2.0
diameter	1	1.2	1.4
d ⁴	1	2	4
Δp	1	0.5	0.25



The narrowest cross-section area in the nose (cm²). 1 1.4 2.0

Water pressure (cm). 8 4 2

Inspiratory force: Intense Normal Nozovent

Figure 1. The correlation between the narrowest cross-sectional area in the nose and the intrathoracic negative pressure during inspiration.

When one snores, the energy in the inhaled air starts the vibrations of the palate and soft tissues of the throat, creating the snoring sounds. One way to prevent snoring is to inspire less heavily, which can be achieved by dilating the nostrils. A good effect on snoring when using Nozovent has been presented previously by

Petruson (1989). The aim of this study was to test the dilator in more patients, and also to evaluate the effect on dryness of the mouth in the morning.

SUBJECTS AND METHODS

In the study were included 18 patients, who told they had snoring problems when visiting the outpatients' departments of ENT and Allergy at the Salhgren's Hospital. One of the male patients did not complete the study; of those who did, 14 were male and 3 female with an age between 26 and 75 years. During the night the sleeping partner was awakened by snoring occasionally in 7, several times in 7, and continuously in 3 patients. Dryness of the mouth during the night or in the morning was noted occasionally in 6, several times in 6, and continuously in 2 patients.

During the test period of ten nights, each one of the patients had to sleep every second night with the nasal dilator Nozovent, as reported in a previous publication (Petruson, 1989). Every morning during the test period the past night was scored; the snoring by the sleeping partner, and dryness of the mouth by the patient himself. The scale for scoring was from 0 to 3 points (0: no snoring or mouth dryness; 1: slight; 2: moderate; and 3: severe). In all, 85 nights without and 85 nights with Nozovent were scored.

RESULTS

As shown in Figure 2 there was a significant decrease ($p < 0.001$) in snoring from, in average, moderate to slight according to the sleeping partners during the nights

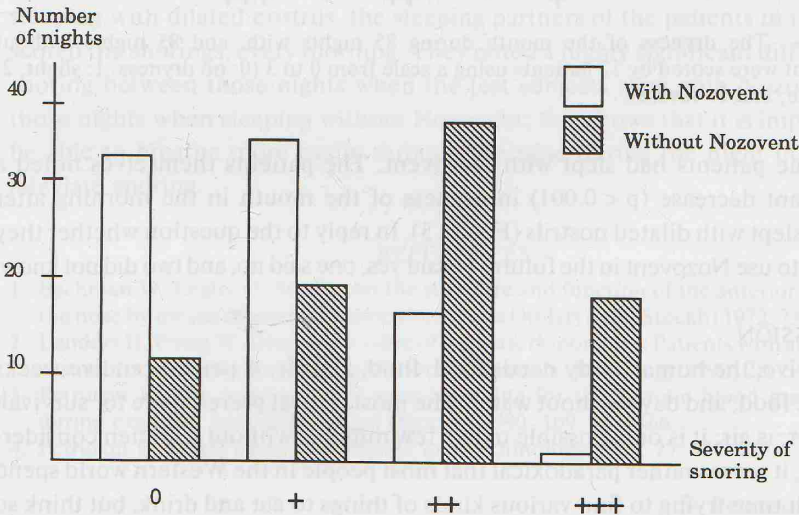


Figure 2. The snoring sounds during 85 nights with, and 85 nights without Nozovent were scored by the sleeping partners of 17 patients using a scale from 0 to 3 (0: no snoring; 1: slight; 2: moderate; and 3: severe).

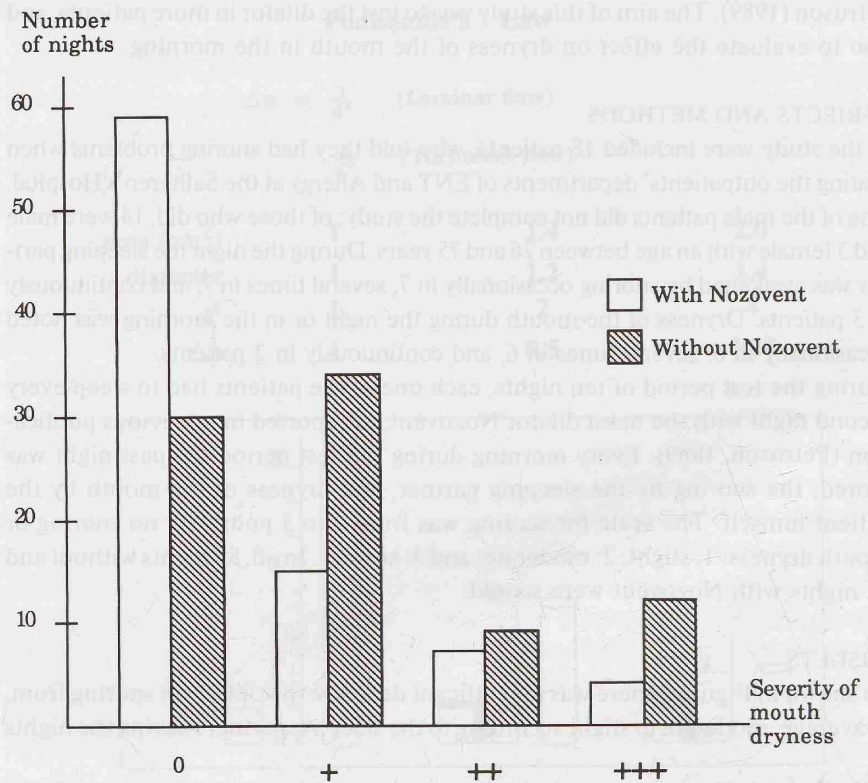


Figure 3. The dryness of the mouth during 85 nights with, and 85 nights without Nozovent were scored by 17 patients using a scale from 0 to 3 (0: no dryness; 1: slight; 2: moderate; and 3: severe).

when the patients had slept with Nozovent. The patients themselves noted a significant decrease ($p < 0.001$) in dryness of the mouth in the morning after having slept with dilated nostrils (Figure 3). In reply to the question whether they wanted to use Nozovent in the future, 14 said yes, one said no, and two did not know.

DISCUSSION

To survive, the human body needs food, fluid, and air. A person can live weeks without food, and days without water. The most critical prerequisite for survival, however, is air; it is only possible to live few minutes without it. When considering this, it seems rather paradoxical that most people in the Western world spend so much time trying to find various kinds of things to eat and drink, but think so little about the availability of air, especially through the nose with its eminent capacity for air-conditioning.

Nozovent, which dilates the nostrils, is the first, really useful device to increase

the access of warmed, humidified and clean air in a simple way. When one can not breathe through the nose, one has to inspire the air through the mouth which has a far lesser air-conditioning capacity. The airflow down to the lungs is colder, drier and dirtier than that inhaled through the nose. As a consequence, the mucosa in the mouth, throat and bronchies becomes dry and irritated.

During the night many people can not breathe properly through their noses and, as a result, wake up in the morning with a dry throat. In order to evaluate whether this could be prevented by sleeping with dilated nostrils, the patients in this study were asked to score the dryness in their mouth, when sleeping with and without Nozovent. We found a highly significant difference between the nights, which shows that it is important to use the air-conditioning capacity of the nose to prevent inconvenient mucosal dryness of the oropharynx during sleep.

In order to inhale one has to expand the chest with the respiratory muscles to create a negative intrathoracic pressure, whereafter the air is sucked into the lungs. When expanding the chest quickly or forcefully, or when inhaling intensely, the air rushes alongside the soft palate; at night, when the palate is relaxed, there is an increased risk for vibrations creating the snoring sounds. By using Nozovent the narrowest cross-sectional area of the airway, i.e. the nostrils, is increased from, in average, 1.4 cm² to that of the bony piriform aperture averaging 2 cm², as has been measured with acoustic rhinometry (Lenders and Pirsig, 1990). In this way, the negative intrathoracic pressure, needed for inspiration, can be reduced to half, thus decreasing the risk for vibrations of the palate. In order to evaluate whether snoring could be decreased or prevented when sleeping with dilated nostrils, the sleeping partners of the patients in this study scored the snorings, every morning. They noted a highly significant difference in snoring between those nights when the test subjects slept with Nozovent and those nights when sleeping without Nozovent; this shows that it is important to be able to breathe more easily through the nose during the night in order to alleviate snoring.

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