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CASE REPORT

Global Neurology

Stabilizing Effect of Yawning on Nasal Cycle

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Abstract

The dominant passability of the left or right nostril in terms of nasal air resistance can be classified into 4 main modes. In the first mode, both nostrils are closed and have equal and low air passability. In the second mode, the passability of the right nostril is higher than the left. In the third mode, the passability of the left nostril is higher than the right. In the fourth mode, both nostrils are open and passability of nostrils is equal and high. The first and fourth modes are unstable (with duration- minutes). The second and third modes are stable (with duration-hours). Author presents a yawning as physiological reflex leading to transition from unstable to stable modes.

Keywords: *yawning, physiological reflex, nostrils, air passage, consciousness*

Introduction

Yawning consists of an involuntary wide opening of the mouth and long and deep air inhalation through the mouth, followed by a slow expiration with duration from 3 to 45 s [1]. Yawning may be associated with tears, shivering, obstruction of the Eustachian canal, stretching of the limb, monotonous work and others. One commonly held notion is that yawning functions to modify levels of oxygen and carbon dioxide in blood [2]. A more recent hypothesis proposed that yawning facilitates arousal [3]. Indeed, the yawning always announces a stage between awakeness and sleep. Regardless of the proposed hypotheses, up to now, there is no research in the scientific literature on the effect of yawning on the nasal cycle. Scientific theory consistently states that there are important connections between the nasal passages and the psyche. During spontaneous breathing, inhaling through the left nostril is said by most people to have a calming, beneficial, stabilizing effect, where breathing through the right nostril is destabilizing, excitatory and ultimately enervating [4]. A balance between the two modes is thought to be most suitable for the challenges of daily life, and is put forth as a teleological explanation for the ultradian rhythm of congestion/decongestion that occurs in the nose throughout the day. This cycle of naturally occurring congestion in one nostril with relative decongestion in the other nostril, followed by the reverse, occurs every 1.0-5.0 hours [5]. Central nervous system and hemisphere brain EEG activity correlates of nostril laterality documented by [6]. The nasal cycle during night sleep multiple to time-period of about 1.5h and synchronized with sleep cycle. The synchronization of the nasal and sleep cycle leads to switch of nostril air passage (from left to right dominating passages and reverse) during the REM phases of sleep, firstly documented by Atanasov et al. [7,8]. In this connection, the first daily nasal cycle starts during the last REM sleep cycle. After waking up and passing from passive (relaxed) state to active (concentrated) state of the mind, the necessity of higher brain, body and psych activity arise. This can be achieved by series of yawning which lead to higher metabolic activity of brain and body [1]. Data of Atanasov [9] show that the nostrils cavity have four mode of work, regard to domination of left or right nostril air passability (Figure 1). In the first mode, the two nostrils are closed (with equals and lower air passability). This mode is observed during strong fatigue, insufficient sleep or headache. The second mode of the nasal cycle (with low air flow trough left nostril and high trough right nostril) it is observed during relaxation, warming the body, boredom, drowsiness and lower concentration capacity. The third mode of the nasal cycle (with high air flow trough left nostril and low trough right nostril) it is observed during concentration, cooling of the body and transition from passive to active state of brain, psych or skeletal muscles. In the forth mode of the nasal cycle the two nostrils are open (with equal and high air passability). This mode is observed during hyperactivity of brain, psych and intense physical or mental pressure. The first and fourth modes are unstable (have a duration of less than 10-30 minutes). The second and third modes are stable (have a duration about 1-5 hours). The effect of yawning on the nasal cycle and nostril's air permeability has not been studied in the scientific literature. The physiological meaning of yawning is still unclear [10]. Thus, the aim is to study the effect of yawning on the nasal cycle.

Working Hypothesis

The first and fourth modes are unstable (have a duration of less than 30 minutes). The second and third modes are stable (have a duration about 1-5 hours). Author presents a yawning as physiological reflex leading to transition from unstable first and forth modes to stable second and third modes. During daily work it is required higher attention and higher metabolic activity. This is achieved by series of yawning, one after another, leading to transition from mode 1, 2 and 4 to mode 3. During mind and physical relaxation, the yawning lead to transition from mode 1, 3 and 4 to mode 2.

Method

Ten (5 males and 5 females) healthy persons, aged between 18 and 55 years (medical doctors and student), volunteered as a subject. The airflow temperature from each nostril separately was measured using two termistors, inserted in cylinders with diameter 1 cm. The cylinders was inserted slightly in the nostrils and fixed to the nose by a facemask. The signals from two termistors were amplifies and registered as the method used from Mirza et al. [5], and Atanasov et al. [7, 8]. The breathing trough left and right nostril was separately registered.

Result and Discussion

Upon all of the participants, regarding of their age, the yawning lead to one and same stereotypic reactions. Firstly, the yawning occurs when the left and right nostrils have nearly equal air passability. On Figure 2 is illustrated that all modes with equal passability (Figure 2, picture 1) generate yawning that lead to modes with different air passability (Figure 2, picture 2). In all cases, after yawning, the air passability of the right nostril decreases, while the air passability of the left nostril increases. This leads to domination of mode 3. Secondly, the yawning has stabilizing effect on mode 3 during active mind and physical activity, and has stabilizing effect on mode 2, during transition to lower physical and psych activity. The duration of transition from unstable modes with equal air passability to stabilized modes with different air passability (after series of 3-4 yawning) varies between 12-20 minutes and more. On Figure 3 is demonstrated the stabilizing effect of yawning on 2 and 3 modes. From this figure can observed that on the one hand, the yawning leads to transition from mode 1 and 4 to mode 2 and 3, and on the other hand leads to inter-transition between mode 2 and mode 3. Third, during daily time in 60-70% of all cases the final effect of yawning leads to stabilization of mode 3. For example, on Figure 4 is shown record of the air flow passages through nostrils of healthy man (50 years). The airflow of the left nostril is increased after each following yawning. Mode 3 is established and stabilized after series of tree yawning. The experiment shows - after this, yawing stops. The stabilizing effect of mode 3 on psyche do not study in scientific literature, but possibly this effect has a connection with contra-laterally function on brain hemisphere. Commonly, the establishing of mode 3 occur after series yawning and alternative nostrils switching from modes 1, 2 and 4 to mode 3 and reverse for time-periods of about 3 up to 15-20 min and over. This alternative nostril switching is very similar to alternative breathing trough left and right nostrils in yoga-practice for period to 20-30min, leading to clearing and stabilizing of the mind. During a yawning, a massive inspiration of oxygen and exhalation of CO2 serve to reverse blood hypoxia and to increase the metabolic rate. This reverse drowsiness, maintaining the brain at the level of alertness needed for wakeful activities [9]. Possibly the metabolic level of the brain and body is connected with domination of nostril's air passage. Thus, the study confirms the hypothesis that, the nasal cycle possibly is associated to different states of consciousness [11,12]. In future, an additional technique and methods are need to strengthen the proposed hypothesis.

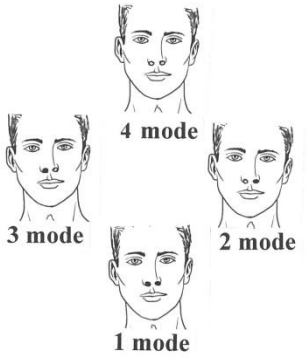

Figure 1. *Four modes of work of nasal cavities in relation to air dominant passages trough left and right nostrils.*

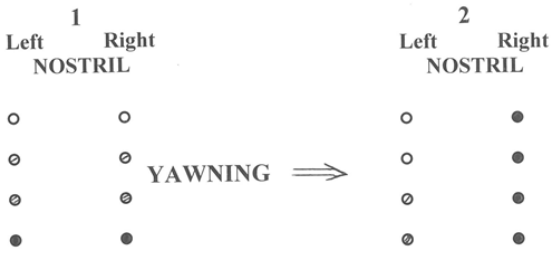

Figure.2. *All modes with equal air passability (picture 1-on the left) generate yawning that lead to modes with different air passbility (picture 2-on the right). After yawning, the air passability of the right nostril decreases, while the air passability of the left nostril increases.*

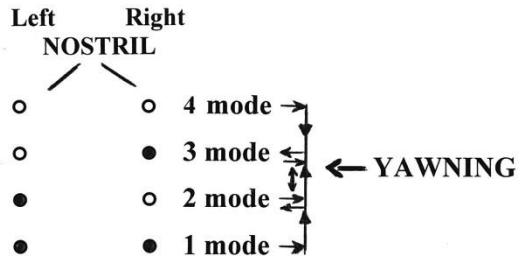

Figure 3. *Stabilizing effect of yawning on 2 and 3 modes.*

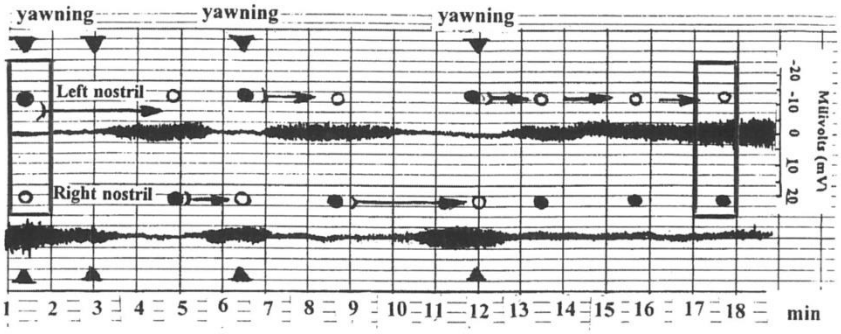

Figure 4. *Stabilizing effect of yawning from mode 2 to mode 3. The nasal cycle goes from 2 mode (marked with a rectangle at the beginning of the recording) to mode 3 (marked with a rectangle at the end of the recording). A series of yawning lead to domination of left over right nostril air flow (establishing of mode 3). The higher air passage trough open nostril cavity have high amplitude of record (from -5mV to +5mV). The lower air passage trough closed nostril cavity have low amplitude of record (from -1mV to +1mV).*

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