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Endoscopic evaluation of therapeutic effects of *"Anuloma-Viloma Pranayama"* in *Pratishyaya* w.s.r. to mucociliary clearance mechanism and Bernoulli's principle

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Abstract

The current endeavor intended to evaluate the effectiveness and mode of action of *Anuloma-Viloma Pranayama* (AVP), i.e., alternate nasal breathing exercise, in resolving clinical features of *Pratishyaya*, i.e., rhinosinusitis. The present study was directed to validate the use of classical "saccharin test" in measuring the nasal health by measuring mucociliary clearance time. This study also highlights the effects of AVP by application of Bernoulli principle in ventilation of paranasal sinuses and surface oxygenation of nasal and paranasal sinuses ciliary epithelium. Clinically, endoscopically and radiologically diagnosed patients of *Pratishyaya*, i.e., rhinosinusitis, satisfying the inclusion criteria were selected to perform AVP as a breathing exercise regularly for 30 min every day in order to evaluate the effectiveness of AVP in resolving features of rhinosinusitis. Saccharin test was performed before and after completion of 40 days trial to assess the nasal ciliary activity, which has been proved to be directly related to the health of ciliary epithelium and nasal health overall as well. AVP may be regarded as a catalyst to conspicuously enhance ventilation and oxygenation of the paranasal sinuses and the positively effect the nasal respiratory epithelium by increasing better surface availability of oxygen and negative pressure in the nasal cavity itself.

Key words: *Anuloma-Viloma Pranayama*, Bernoulli principle, mucociliary clearance time, nitric oxide, *Pratishyaya* (rhinosinusitis) and saccharin test

Introduction

While going through the Ayurvedic literature, we observe a vivid description of the disease "*Pratishyaya*". There is a descriptive mention of this disease with regard to etiopathogenesis, classification, symptomatology, complications and management. This reflects that the ancient Ayurvedic galaxy was well-versed with the concept of *Pratishyaya*. *Pratishyaya* is a *Vata-Kapha* predominant *Tridoshaja* disease. The disease is the most elaborated disorder among all "*Nasa Rogas*," but the description seems to be scattered at various places. The disease has got localized as well as somatic effects and accepted as a potential cause of "*Kshayaroga*."[1] Hence, the management of *Pratishyaya* should never be neglected or delayed in this respect. *Doshaja* classification of *Pratishyaya* represent different types of rhinitis and each of this type of *Pratishyaya* when gets complicated with added difficulties during treatment, then a common term "*Dushta Pratishyaya*" is used.[2] After evaluating the etiological factors, symptomatology and complications of the disease *Pratishyaya* it seems quite prudent to accept that these features has got close proximity and compatibility with most common rhinological disorder in modern counterpart termed as "rhinosinusitis."

Rhinosinusitis affects millions of the population throughout the globe. Despite the enormity of the problem, the pathophysiology of the disease still eludes the scientific community. Unfortunately the nose, with its convoluted architecture is prone to obstructive diseases. Although, the mucociliary pathways work harmoniously in health, infection can rapidly throw this delicate mechanism into disarray.[3] Most infection of the paranasal sinuses arise from primary focus in the nose and ciliary dysfunction being the most important factor responsible for the genesis of rhinosinusitis. Anderson in 1974 introduces the use of Saccharin in estimating time interval between putting this saccharin in the nasal mucosa

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and perception of sweet taste as a diagnostic tool for the measurement of nasal mucociliary function. This "Saccharin test" then becomes a gold standard diagnostic tool for the evaluation of ciliary function world-wide.[4]

Three factors, however appears to be crucial for the normal physiological functioning of the nose and para-nasal sinuses, i.e., normal mucociliary transport, patency of osteomeatal unit and normal quality and quantity of secretions. Disruption of any one or more factors can predispose rhinosinusitis. Mucociliary clearance mechanism (MCCM) is the most important of all of these factors and is the most important guiding factor in genesis of rhinosinusitis and is confirmed by various histocytological, beat frequency, viscolastic, electron microscopic and ciliary dynamic studies of the nasal mucosa, which is pseudo stratified ciliary columnar in appearance histologically.

The most important responsible factor for ciliary health is oxygenation of the cilias, which is maintained both by diffusion from the circulating blood as well as from the surface itself. This particular observation also encourages in evaluating an extremely popular and time tested oxygenation breathing exercise viz.,"*Anuloma-Viloma Pranayama*" (AVP) in this present study. Failure to achieve satisfying degree of success by using modern medical treatment in established chronic rhinosinusitis also dictates for choosing a non-invasive, rapidly gaining popularity and a time tested healing modality of AVP for the proposed study. AVP was selected for being simple to practice, modified form of normal respiration mechanism and it's well documented and widely accepted function of enhancing ciliary oxygen saturation, which is the most important single factor for reverting ciliary health from abnormal to normal.

Materials and Methods

The present work is randomized, prospective and single center study comprising patients of either sex in the age group 16-70 years. Patients for the research were selected from Department of Shalakya Tantra OPD. Established and diagnosed patients satisfying inclusion/exclusion and criteria of assessment were selected after having written and informed consent from the patient to participate in the study on a recorded and standardized proforma. All patients were briefed and also provided a hard copy document about the research protocol, duration of trial, technique of the AVP and dietary modifications including foods to eat and foods to avoid, to be followed with AVP regimen prior to the consent. An official permission from institution's research ethical committee and hospital core committee was also taken before the commencement of the trial.

Statistical analysis

The data was analyzed for statistical significance by using statistical package for social sciences (SPSS Inc. Chicago, USA, 17.0). The Student's *t*-test (paired) were used to analyze the data for in pre-/post-protocol. For all analysis the *P* value used for statistical significance was 0.05.

Selection of the patients

Inclusion criterion

- Clinically, endoscopically and radiologically diagnosed patients of *Pratishyaya*, i.e., rhinosinusitis.
- Patients of age group 16-70 years.
- Patients having various clinical features depicted in criteria of assessment later.

Exclusion criterion

- Patients exhibiting gross anatomical distortion of septum or osteomeatal complex impeding diagnostic endoscopy.
- Patients presenting with various complications of sinusitis viz. intra orbital or intra cranial complications.
- Patient having concomitant benign or malignant growth of the nasal cavity with rhinosinusitis.
- Patients hypersensitive to local anesthetic agent, i.e., lignocaine.

Criteria of assessment for the present study

Clinical features (rhinological)

a. Nasal obstruction/blockage.
b. Unilateral/bilateraldiscolored nasal discharge.
c. Decreased sense of smell.
d. Itching/irritation of the nasal cavity.

Clinical features (non-rhinological)

a. Headache.
b. Post-nasal drip.
c. Itching/irritation of the throat.
d. Fullness/pressure of the ears.

Grading and scoring system of criteria of assessment

Visual analog scale was used for grading and scoring of clinical features in the present study [Table 1].

Investigational parameters

Endoscopic parameters

a. Polypoidal changes in the middle meatus.
b. Discharge in the middle meatus.
c. Edema of the middle meatus.
d. Crusting of the middle meatus.

Done by using "Shenda"autoclavable 0°, 4 mm rigid nasal endoscope with videoscopy unit.

Grading and scoring of endoscopic parameters

For the present study Lund-Kennedy scale[5] was adopted, which has been recommended and endorsed by various sinonasal studies and also forwarded by International Otolaryngology Society (IOS), USA [Table 2]. This classification represents unilateral disease involvement and hence for bilateral representation this score should be doubled. Maximum score possible in case of unilateral presence of a disease is $4 \times 2 = 8$ and in case of bilateral presence the maximum score available was $8 \times 2 = 16$.

Radiological parameter

Haziness of the different sinuses is the prime observation in this study for the assessment of the disease. X-ray PNS (OM's view) with the sitting position and open mouth and/or coronal computed tomography scan of PNS with 120 kV and 150 mA with 5 mm interval and 2 s. scan time. The slice thickness was 3 mm for osteomeatal unit and 5 mm for other sites. The window width was 2000 for the study.

Grading and scoring of radiological parameters

For the present study, Lund-Mackay scale[6] was adopted, which has been recommended and endorsed by various sinonasal

Table 1: Grading and scoring system of criteria of assessment

Clinical feature	0	1	2	3	4	5
Nasal obstruction/ blockage	No obstruction	Mild obstruction	Moderate/bother some obstruction	Moderately severe	Severe	Very severe
Discolored nasal discharge	No nasal discharge	Mild nasal discharge	Moderate/bother some	Moderately severe	Severe	Very severe
Decreased sense of smell/hyposmia	Nohyposmia	Mild hyposmia	Moderate/bother some	Moderately severe	Severe	Very severe
Itching/irritation of the nasal cavity	No itching/irritation	Mild itching/irritation	Moderate/bother some	Moderately severe	Severe	Very severe
Headache	No headache	Mild headache	Moderate/bother some	Moderately severe	Severe	Very severe
Post-nasal drip	No post-nasal drip	Mild post-nasal drip	Moderate/bother some	Moderately severe	Severe	Very severe
Itching/irritation of the throat	Noitching/irritation	Mild itching/irritation	Moderate/bother some	Moderately severe	Severe	Very severe
Fullness/pressure of the ears	No fullness/irritation	Mild fullness/irritation	Moderate/bother some	Moderately Severe	Severe	Very severe

studies and also forwarded by IOS, USA [Table 3]. This classification represents unilateral disease involvement and hence for bilateral representation this score should be doubled. Maximum score possible in case of unilateral presence of a disease is $4 \times 2 = 8$ and in case of bilateral presence the maximum score available was $8 \times 2 = 16$.

Saccharin mucociliary clearance (MCC) test

A simple test of nasal MCC is to place particles of saccharin approximately 1 cm behind the anterior end of the inferior turbinate. In the presence of normal mucociliary action the saccharin will be swept backwards to the nasopharynx and a sweet taste is perceived. The saccharin test is a simple and inexpensive method to perform and results are similar to those of obtained by using a radio actively labeled particle. The saccharin test was carried out by the method described by Andersen *et al.* and modified by Rutland and Cole. The patient was instructed not to sniff, sneeze or cough during the test and to report a sweet taste as soon as it is perceived. The time duration of crystal saccharin placement in the nasal cavity and the perception of a sweet taste were recorded in minutes. If no taste was apparent after 60 min the test was stopped and the ability of the subject to taste saccharin was verified by putting it directly on the tongue. Any mucociliary clearance time (MCCT) greater than 45 min is regarded as abnormal which is also endorsed by Andersen *etal*. Reproducibility of this test was also established by repeating this test in 8 patients 2 weeks later after evaluating their initial MCCT. The reproducibility shows insignificant change from the initially recorded time value.

Grading and scoring of nasal MCCT

Time interval from instillation of saccharin in nasal valve area to perception of sweet taste by the patient was nominated as nasal MCCT. This test of nasal mucociliary function was done as per recommendation of Anderson's classical "Saccharin test" [Table 4].

Study design

A total of 46 diagnosed patients of *Pratishyaya*, i.e. rhinosinusitis, satisfying the inclusion criteria were enrolled in the present trial of which 6 patients were dropout in follow up [Table 5].

Table 2: Lund-Kennedy scale for sinonasal studies

Criteria of assessment/ endoscopic observation	Scores		
	0	1	2
Polyps in the middle meatus	Absent	Restricted to middle meatus	Beyond the middle meatus
Discharge in the middle meatus	Absent	Thin and clear discharge	Thick and purulent
Edema of the middle meatus	Absent	Mild-moderate	Moderate-severe
Crusting in the middle meatus	Absent	Mild-moderate	Moderate-severe

Table 3: Lund-Mackay scale for radiological parameters

Criteria of assessment/ radiological observations	Scores		
	0	1	2
Maxillary sinus	No haziness	Mild haziness	Complete haziness
Frontal sinus	No haziness	Mild haziness	Complete haziness
Ethmoidal sinus	No haziness	Mild haziness	Complete haziness
Sphenoid sinus	No haziness	Mild haziness	Complete haziness

Table 4: Nasal mucociliary clearance time

MCCT	Grading	Scoring
≤30 min	Normal	0
≥31 to ≤40 min	Mildly increased	1
≥41 to ≤50 min	Moderately increased	2
≥50	Severely increased	3

MCCT: Mucociliary clearance time

Table 5: Study design and preamble of *Anuloma-Viloma Pranayama* practice in patients under trial

Trial group	Treatment modality	Total no. of patients	Dosage	Duration of trial	Follow-up
Pranayama	*Anuloma-Viloma Pranayama*	40	30 min daily (morning and evening)	40 days	For 2 months

Over all results interpretation

Overall results were adjudged in terms of percentage relief observed by the patients in pre described criteria of assessment (rhinological, non-rhinological, endoscopic and radiological parameters). This protocol of out-come of treatment is in accordance to global rating of response to the treatment protocol [Table 6].

Table 6: Overall results

Treatment outcome	Percentage relief
Cured	100
Markedly improved	>75
Moderately improved	≥50 to ≤75
Slightly improved	≥25 to <50
Unchanged/unimproved	<25
Deteriorated/worsened	Negative

Observations and Results

This group of 40 patients was subjected to practice AVP (alternate nostril breathing exercise) for 40 days for a period of 30 min daily along with dietary recommendations[7] and then followed up for 2 months. Detailed methodology was practically demonstrated as well as documented/written guidelines were also issued on a paper (predestined). Paired *t*-test was applied on the pre-conceived parameters [Table 7]. For all analysis, the *P* value used for statistical significance was 0.05. Overall ramification of the final outcome of the treatment modality, i.e., AVP was also tabulated [Table 8].

Discussion

MCCM and saccharin test

The entire mucous membrane of the nasal cavity and also the paranasal sinuses are conspicuously covered with this mucous blanket. This covering blanket is effective in entrapping almost 75% of the bacteria gaining entrances into the nasal cavity. MCC, the clearance of mucus and other material from the airways by ciliary beating of the epithelial cell, which move mucus cephalad with every beat. MCC comprises the cephalad movements of mucus caused by the cilia lining the conducting airways until it can be swallowed or expectorated. The respiratory cilia are extremely effective in transporting mucus, trapped inhaled particles and bacteria propelling materials at a speed of 3-25 mm/min. The beat rate is normally about 12 Hz. The sinuses are generally kept sterile since deposited bacteria are rapidly removed by the action of cilia and taken care of by the immunologic defense system.[8]

MCC is a very complex process in which many variables are involved, all of which may modify the final out-come. The structure, number, movement and co-ordination of the cilia present in the airways as well as the amount, composition and rheological properties of the periciliary and mucous layers are determinants of MCC. Physiological factors such as age, sex, posture sleep and exercise are reported to influence MCC due to change in the cilia, the mucus or the periciliary layer or a combination of these. Analysis of MCC can provide ground for diagnosis of certain diseases and also can help to assess the effect of nasal diseases on nasal ciliary health and can also validates effects of certain treatments. In rhinosinusitis early diagnosis can ensure that appropriate treatment is introduced as soon as possible, thereby slowing the progressive decline in nasal functions.[9]

A secretory mucosa and unobstructed mucociliary transport are essential to respiratory and olfactory functions of the nose and to health of the nasal cavities along with the paranasal sinuses. The osteomeatal complex within the narrow cleft of the middle meatus is susceptible to obstructions of mucociliary flow from the sinuses. Mucosal swelling, polyps and altered properties of secretion that result from common nasal disorders can impair MCC and sinus disease is a common consequence.[10-13]

Saccharin clearance time has been used for many years as a test of mucociliary function in the nasal cavity. In the present study also an attempt has been made to replicate the previous findings that used saccharin clearance time as a measurement of nasal function and to validate the assumptions that underlie the use of the test in previous studies. It has been found that tests that employ saccharine or similar substances are useful for scientific investigations, easy to perform, without the need of sophisticated equipment and don't cause too much of subject discomfort. The correlation between nasal and tracheobronchial MCC rates has been well-established, underlining the utility of studying nasal mucociliary transport for investigating overall mucociliary function without resorting to invasive methods. Literature provides ample evidences to suggest that saccharin clearance test is a reliable and robust test for the assessment of nasal mucociliary function and hence nasal health. Knowledge of the MCCT would indicate how values vary according to different factors and conditions of possible clinical relevance: Humidity, temperature, ciliary oxygen concentration, exposure to tobacco smoke, environmental pollutants, anesthetics and respiratory diseases (chronic obstructive pulmonary diseases, cystic fibrosis, primary ciliarydyskinesias, bronchiectasis and asthma). Such inference would also help in the assessment of whether therapeutic measures in general are able to have a positive or negative effect on clearance of respiratory secretions.

Pranayama, the fourth limb of the *Ashtanga Yoga* provides a variety of breath regulation methods. There are many *Pranayama* methods for moderation of breathing. One of the classical examples is AVP or alternate nasal breathing. Clinical studies have been conducted to understand the efficacy of unilateral nostril breathing. In 1948, Friedell reported the first clinical trial using alternate nasal breathing for symptoms of rhinitis and sinusitis on 38 patients. It was shown that alternate nasal breathing has profound effects on relieving symptoms of

Table 7: Effect of "*Anuloma-Viloma Pranayama*"in 40 patients of *Pratishyaya*, i.e., rhinosinusitis under trial

Signs and symptoms	*N*	Mean		X (d) BT–AT	% relief	SD±	SE±	*t* value	*P* value	Remark
		BT	AT							
Nasal obstruction	40	2.175	0.9	1.275	58.62	0.598	0.094	13.47	<0.001	HS
Discoloured nasal discharge	40	2.175	0.8	1.375	63.21	0.627	0.099	13.85	<0.001	HS
Decreased sense of smell/hyposmia	40	1.875	0.85	1.025	54.66	0.733	0.116	8.84	<0.001	HS
Itching/irritation of the nasal cavity	37	1.875	0.75	1.125	60	0.791	0.125	9	<0.001	HS
Headache	37	1.925	0.8	1.125	58.44	0.757	0.120	9.39	<0.001	HS
Post-nasal drip	38	2.15	0.675	1.475	68.6	0.784	0.124	11.90	<0.001	HS
Itching/irritation of the throat	38	2.275	0.925	1.350	59.34	0.802	0.127	10.64	<0.001	HS
Fullness/pressure of the ears	38	2.1	0.9	1.15	54.76	0.770	0.122	9.45	<0.001	HS
Endoscopy	40	6.1	3.375	2.725	44.67	1.853	0.293	9.30	<0.001	HS
Radiology	40	7.025	3.8	3.225	45.90	1.928	0.305	10.58	<0.001	HS
Mucociliary clearance time	40	1.575	0.575	1	63.49	0.599	0.094	10.56	<0.001	HS

SD: Standard deviation, SE: Standard error, BT: Before treatment, AT: After treatment, HS: Highly significant

Table 8: Overall results of the trial

Cured	Markedly improved	Moderately improved	Slightly improved	Unchanged/unimproved	Deteriorated/worsened
0	4	12	18	6	0

rhinosinusitis and eventually was able to even curtail the use of steroidal nasal sprays.

It is found that the nasal epithelium takes up ambient O_2 and excretes CO_2 under normoxic conditions; i.e., epithelial gas exchange occurs. Indeed it has been demonstrated that O_2 concentration in the sinus falls when the ostium is occluded in chronic sinusitis suggesting that the sinus epithelium can continuously take up air-borne O_2 and excrete CO_2; i.e., gas exchange occurs.[14] Kelley and Dubois demonstrated that nasal superficial capillary blood flow was 13-16 ml/min out of a cardiac output of 5,000 ml/min or 0.3% of cardiac output. Although the tissue metabolism is not necessarily proportional to the local blood flow, the higher percentage of the nasal metabolism than the blood flow indicates that in addition to the O_2 supplied from the blood, the nasal epithelium may consume much more O_2 from the ambient air.[15]

Nitric oxide (NO), a highly diffusible gas is synthesized enzymatically by NO synthase from l-arginine and molecular O_2 and it has various biological actions. NO, a substance with many important physiologic functions including bacterio-stasis and stimulating ciliary beat-rate and this NO is produced in remarkably large quantities from epithelial cells in the maxillary sinuses.[16] In the nose NO is located in the superficial region of ciliated cells and acts as an upregulator of mucociliary motion and as a host defense.[17] High levels of NO increase ciliary beat frequency whereas low levels are correlated to ciliary dysfunction.[16] Extremely high concentrations of nasal NO have been found in exhaled air from the normal human nasal cavity but NO concentration is reduced in chronic sinusitis. Furthermore, it is hypothesized that epithelial cell metabolism is associated with NO production and that both of these processes are regulated by ambient oxygen (O_2) tension. In chronic sinusitis O_2 tension in the sinus falls as a result of ostial dysfunction and also nasal NO levels is also markedly reduced. Therefore, it is likely that impaired ventilation through the ostium would lead to an O_2 deficiency followed by a decline in NO production resulting in disrupted mitochondrial respiration, mucociliarydysfunction and bacterial infection thereby bringing about epithelial damage. AVP being a modified way of nasal breathing definitely increases the ciliary oxygenation because of enhancing ciliary surface O_2 availability and thus also augments the production of NO, which has got proven mucociliary enhancement properties. It has been scientifically proven that humming which eventually also is a form of breathing technique just like AVPincreases NO level in the nasal cavity,[17] which certainly is important to revert the features of sinusitis from abnormal to normal. Rhythmic diaphragmatic breathing can bring more air and oxygen into the air sacs of the lungs and hence into the blood circulation and may improve the hypoxic state of the cilias of the nasal cavity, paranasal sinuses and the rest of the respiratory tract.[18] Adequate surface as well as systemic oxygenation of the cilias is a must prerequisite for a healthy nasal cavity and the connected paranasal sinuses. AVP can certainly enhance surface availability of oxygen directly and help in more than one ways to satisfy to ciliary need of oxygenation by increasing both surface and systemic oxygen concentration level.[19] The reversal observed in MCCT may also be attributed partially to the yogic diet, which was recommended to be followed as a part of the AVP regimen as Indians are prone to dietary Vitamin A deficiency, which again is a tenacious factor for the regulation of the mucociliary function.[20-22]

Bernoulli's principle is a physical phenomenon that was named after the Swiss scientist Daniel Bernoulli who lived during the eighteenth century. Bernoulli studied the relationship of the speed of a gas and pressure. Bernoulli's Principle simply states that the faster an air moves over a surface, the less it pushes on the surface or negative pressure is created in the cavity through which this air is passing. In simple words, it can be interpreted that velocity of the air passing through a cavity is directly proportional to the negative pressure (sulking effects) created by the moving air in the cavity itself [Figure 1].

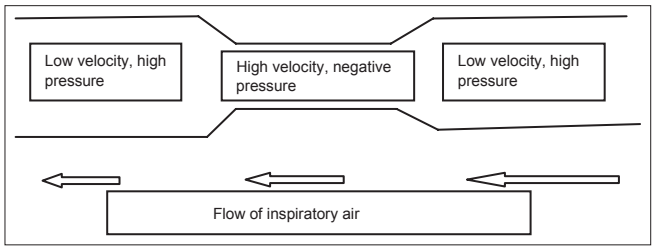

Figure 1: Bernoulli's principle (Bernoulli's principle says that increased air velocity produces decreased pressure)

Application of bernoulli principle in sinus ventilation

For evaluating the effects of the streaming air the Bernoulli principle states that if air flows through a pipe of varying cross-section, its velocity is higher and the pressure lower at the constriction compared with at the larger part. A Venturi tube offers the best demonstration of the Bernoulli principle. As rapidly moving airflows through the narrow parts of the upper airway, the Bernoulli principle predicts that negative pressure is created. This principle is illustrated by a drinking straw: if too much velocity of negative pressure is generated within the straw it collapses; as the negative pressure decreases, the straw becomes more rigid and does not collapse. A jet of air in the nose, delivered through the passage of varying cross-section would inevitably, in those areas of lower cross section will have a higher velocity and will cause suction to be established.[23] When in the nose ostia of different sinuses are sufficiently constricted areas, suction in a greater efficacy must have happened when increased velocity event, i.e., AVP is performed. Although Bernoulli proposed this principle some 250 years ago and it is so commonly accepted that it is referred to in every elementary text of physics and applied in hydraulic and aeronautical engineering, it is not commonly applied in the physiology and dynamic studies of respiration. Furthermore in the reciprocal of the inspiratory phase of respiration, when a deep expiration, which exactly is the integral part of AVP, sinus tends to inflate much more effectively than normal expiration phase of respiration purely because of positive pressure, which is created in the nasal cavity during second phase of AVP.[24]

Conclusion

AVP enhances mucociliary beats of the respiratory epithelium, which is directly reflected by statistically significant reduction of MCCT in Saccharine test. This improvement of clinical features, endoscopic and radiological parameters by practicing alternate nasal breathing may be attributed to enhancement of systemic oxygenation, better surface availability of oxygenation of nasal ciliary epithelium and dietary modification recommended during the AVP practice, which perhaps counter the deficiency of vitamin A, which has got the proven relation with nasal mucociliary function and Indians are rather prone to that case. Apart from that better ventilation of paranasal sinuses by effective application of Bernoulli's principle in the nasal cavity is also responsible for making AVP such as important breathing technique to combat the established features of rhinosinusitis.

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हिन्दी सारांश

अनुलोम विलोम प्राणायाम का प्रतिश्याय पर चिकित्सिय प्रभाव

अतुल भारद्वाज, महेन्द्र कुमार शर्मा, मनोज गुप्ता

प्रस्तुत शोधपत्र में विभिन्न मानकों द्वारा स्थापित प्रतिश्याय के ४० रोगियों को ४० दिनों के लिए प्रति दिन ३० मिनिट अनुलोम विलोम प्राणायाम करने के लिए प्रेरित किया गया । इस शोध में अनुलोम विलोम प्राणायाम से पहले एवं बाद में नासा स्वास्थ्य के मूल्यांकन हेतु 'सेकरीन म्यूको क्लियरन्स समय' का निर्धारण किया गया । चिकित्सिय प्रयोग मे परिलक्षित हुआ की अनुलोम विलोम प्राणायाम नासा स्वास्थ्य में नासा के सीलियास के लिए ऑक्सिजन स्तर को वर्धित करता प्रतीत होता है । इसके अतिरिक्त अनुलोम विलोम प्राणायाम बूर्नौल्ली सिद्धांत को प्रभावशाली रूप में उपयोग कर प्रतिश्याय रोग के निदान में उपयोगी सिद्ध होता है ।