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Effects of Intranasal Phototherapy on Nasal Microbial Flora in Patients with Allergic Rhinitis

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ABSTRACT

The objective of this study was to investigate the effect of intranasal phototherapy on nasal microbial flora in patients with allergic rhinitis.

This prospective, self-comparised, single blind study was performed on patients with a history of at least two years of moderate-to-severe perennial allergic rhinitis that was not controlled by anti-allergic drugs. Thirty-one perennial allergic rhinitis patients were enrolled in this study. Before starting the test population on their intranasal phototherapy, the same trained person took a nasal culture from each subject by applying a sterile cotton swab along each side of the nostril and middle meatus. Each intranasal cavity was irradiated three times a week for two weeks with increasing doses of irradiated. At the end of the intranasal phototherapy, nasal cultures were again obtained from the each nostril

The study found that after intranasal phototherapy, the scores for total nasal symptoms decreased significantly but bacterial proliferation was not significantly different before and after phototherapy.

We have shown that intranasal phototherapy does not change the aerobic nasal microbial flora in patients with perennial allergic rhinitis.

Keywords: Adult; Allergic rhinitis; Allergy; Bacteriology; İntranasal phototherapy; Middle nasal meatus; Nasal microbial flora; Phototherapy

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INTRODUCTION

Allergic rhinitis is defined as an inflammatory disease of the nose and the paranasal sinuses, characterized by a specific IgE- mediated hypersensitivity reaction. Allergic rhinitis is considered

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to be one of the most frequent health problem, and is a costly and highly prevalent disease which produces a major negative impact on the patient's quality of life.[1,2,3] Although patients have used intranasal steroids and newly available antihistamines with good results, the symptoms cannot be resolved completely.[4,5] Moreover, in some patients such as pregnant and breastfeeding women, researchers discourage application of these drugs.

Phototherapy has a profound immunosuppressive effect, and therefore phototherapeutic methods using both ultraviolet (UV) and visible light are widely used as therapy for various inflammatory skin diseases.[3,7]

Nasal flora consists of numerous strains of aerobic bacteria that maintain a balance through strategies of antagonism and coexistence. Many practitioners presume that failing to maintain this balance is one of the factors contributing to infectious diseases.[8,9]

Ultraviolet light applied to the nasal passages has been used for the treatment of allergic rhinitis, no investigation has attempted to determine the effects of intranasal phototherapy on nasal microbial flora in patients with allergic rhinitis. The aim of this study was to investigate the effect of intranasal phototherapy on nasal microbial flora in patients with persistent allergic rhinitis.

MATERIALS AND METHODS

This prospective, single blind study was performed among patients with a history of at least two years of moderate-to-severe perennial allergic rhinitis that was not controlled by anti-allergic drugs. The study protocol was approved by the Ethics Committee of the Abant İzzet Baysal Üniversity, located in Bolu, Turkey.

A total of 31 subjects were enrolled in the study. Positive skin test results and an elevated level of specific IgE antibody confirmed the diagnosis of allergic rhinitis.

The study excluded potential subjects who met the following criteria: age <18 or >65 years old; patient presented with significant nasal structural abnormalities such as deviated nasal septum and nasopharyngeal pathology diagnosed via fiberoptic endoscopy; patients with asthma; patients who had had an upper or lower respiratory tract infection within the previous four weeks; patients suffering from the severe autoimmune disease known polymorphous photodermatosis; patients who had used photosensitizing medication; patients suffering from severe autoimmune disease or malignant neoplastic disease; patients who were pregnant; patients who used leukotrienes or beta-mimetic drugs; patients who had used antihistamines within the previous ten days, systemic corticosteroids within the past four weeks, topical corticosteroids within the past two weeks or nasal decongestants within the past seven days; patients receiving ongoing specific immunotherapy or antiallergic medication before the start of the study. Patients using antibiotics were also excluded.

Before starting the intranasal phototherapy, the same trained person took nasal cultures from the each side of the nasal passages of each subject, the middle meatus, with a sterile cotton swab. They illuminated the swabbing area using a headlight and used a Killian nasal speculum with long leaves to prevent contamination of the cotton swabs in the vestibule.

Phototherapy illuminations were carried out by the same person for all subjects, using the same rhinolight device (model Rhinolight III, manufactured and sold by Rhinolight Ltd, Szeged, Hungary).

Each intranasal cavity was irradiated three times a week for two weeks. With the dosage times increasing as follows[5]:

Week 1	1st treatment	2:00 minutes
Week 1	2nd treatment	2:15 minutes
Week 1	3rd treatment	2:30 minutes
Week 2	4th treatment	2:45 minutes
Week 2	5th treatment	3:00 minutes
Week 2	6th treatment	3:00 minutes

The starting dose of 2:00 minutes is equal to 1.6 J/cm^2. Each consecutive treatment raised the dose by 0.2 J/cm^2, reaching the highest dose of 2.4 J/cm^2 at the fifth visit. Throughout the duration of the investigation, the patients were not allowed to take any anti-allergic medication and none of the patients was treated with antimicrobials.

At the end of the intranasal phototherapy, nasal cultures were again obtained from each nostril and the middle meatus.

Each patient was scored based on the signs and symptoms of allergic rhinitis before and after the treatments, as described by Bousquet et al.[10] The scores were based on the following nasal symptoms: nasal obstruction, nasal itching, nasal discharge and sneezing, grading each symptom on a scale from 0 to 3:

Scale	Interpretation
0	None (no symptom present)

1 Mild (symptom is present but is not particularly bothersome)
2 Moderate (symptom is present and bothersome, but does not interfere with daily activities)
3 Severe (symptom is present and bothersome to the point of interfering with daily activities and disturbing sleep)

Microbiology

A blinded microbiologist performed the microbiological study. To isolate microorganisms, the swab specimens were immediately inoculated onto blood agar, chocolate agar, mannitol/salt agar and eosin metilen blue agar, then incubated at 37°C for 24 and 48 hours.

Statistical Analysis

The data were evaluated using the MedCalc statistical software, v11.5.1. The Wilcoxon signed-rank test was used to compare repeated measures variables and the differences between groups were analyzed using the Mann-Whitney U-test and Independent Samples t- test. The data were expressed as the mean ± standard deviation. $P < 0.05$ was considered to be statistically significant.

RESULTS

Thirty-one subjects ranging in age from 20 to 44 years (15 men and 16 women) formed the persistent allergic rhinitis patients. The scores of all total nasal symptoms (TNSS) (nasal obstruction, nasal pruritus, nasal discharge and sneezing) decreased significantly after intranasal phototherapy ($p< 0.0001$). Table 1 shows the data of TNSS before and after the phototherapy procedure.

The comparison of aerobic bacterial proliferation was not significantly different between the study group before and after the phototherapy (Table 2). *Coagulase negative Staphylococcus (CNS)* were the most frequently isolated pathogen (p =0.8605). This result did not change before and after intranasal phototherapy. There were five negative cultures (20%) before phototherapy procedure and also nine (29%) negative cultures after the phototherapy procedure.

Table 1. Total nasal symptom scores (TNSS) before and after phototherapy.

	Mean	Variance	SD	RSD	SEM	Median	Min	Max
Nasal obstruction, baseline	1.6	0.71	0.84	0.52	0.15	2.0	0.0	3.0
Nasal obstruction, after	0.7	0.41	0.64	0.90	0.11	1.0	0.0	2.0
Nasal itching, baseline	2.0	0.39	0.62	0.30	0.11	2.0	1.0	3.0
Nasal itching, after	0.8	0.29	0.54	0.67	0.09	1.0	0.0	2.0
Nasal discharge, baseline	2.2	0.41	0.64	0.28	0.11	2.0	1.0	3.0
Nasal discharge, after	0.8	0.42	0.65	0.81	0.11	1.0	0.0	2.0
Sneezing, baseline	2.5	0.25	0.50	0.19	0.09	3.0	2.0	3.0
Sneezing, after	1.0	0.35	0.59	0.54	0.10	1.0	0.0	2.0

SD: Standard Deviation, RSD: Relative Standard Deviation, SEM: Standard Error of the Mean

Table 2. Values of nasal proliferation in the study group before and after phototherapy.

Topics	Number of cultured patients (n)	Before Phototherapy	After Phototherapy	*P* value
Coagulase negative staphylococcus (CNS)	13	16 (51.6%)	15 (48.3%)	0.8605
Staphylococcus aureus	3	3 (9.6%)	2 (6.4%)	0.1271
Difteroid Bacil	2	3 (9.6%)	2 (6.4%)	0.1271
Alpha-hemolytic streptococci	3	3 (9.6%)	1 (3.2%)	0.0544
Streptococcus pneumoniae	2	2 (6.4%)	1 (3.2%)	0.9100
Moraxella catarrhalis	1	1 (3.2%)	1 (3.2%)	1.0000
Haemophilus influenzae	2	2 (6.4%)	0 (0.0%)	1.0000
Negative culture	5	5 (16.1%)	9 (29%)	0.9117

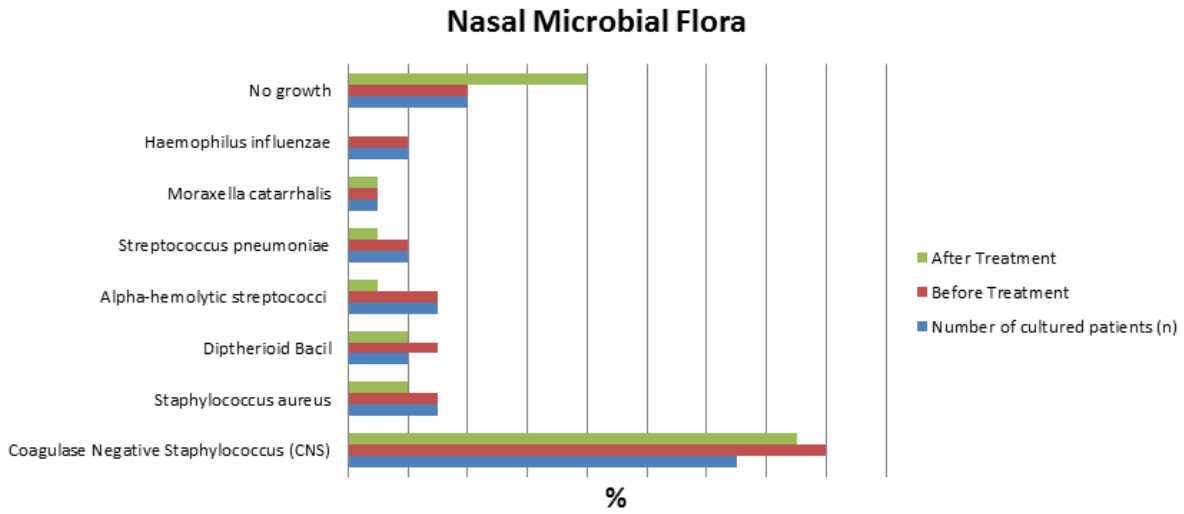

Figure 1. The number of bacteria detected proliferating in the study group before and after intranasal phototherapy.

Table 2 shows the effects of intranasal phototherapy on aerobic nasal flora.

The detected proliferation of bacteria in all positive cultures was not statistically different before and after treatments (Figure 1). At the end of the treatment crustiness and dryness was the most common side effect in all patients.

DISCUSSION

Allergic rhinitis is a social problem which is considered to be a very important disorder due to its high incidence and the severe manner in which it impairs the quality of a patient's life. Many therapy techniques have been used to treat allergic rhinitis. Intranasal steroids and antihistamines are the gold standard of medical therapy. Even without contraindications, many patients do not want to take any medication for the relief of allergic rhinitis.[6]

Koreck et al.[11] proposed that phototherapy, using a combination of UV-A (25%), UV-B (5%) and visible light (70%), may represent a therapeutic alternative for patients with allergic rhinitis. They also noted the efficacy of phototherapy in treating allergic rhinitis and stated that it suppressed significantly the clinical symptoms of allergic rhinitis and locally reduced the number of inflamed cells.

In another study, Koreck et al.[12] showed that intranasal photochemotherapy with ultraviolet A light (PUVA) is effective in treating allergic rhinitis. In that study, PUVA was administered to seven patients with nasal polyposis for six weeks. Phototherapy also resulted in a reduced number of eosinophils and a decreased level of eosinophil cationic protein in the nasal lavage fluid.[3]

Phototherapy has a profound immunosuppressive effect, therefore visible light is widely used as the therapy for various inflammatory skin diseases, including atopic dermatitis.[13]

In our study, rhinophototherapy improved the scores of all total nasal symptoms in patients with allergic rhinitis. Comparing the scores describing the nasal obstruction, nasal itching, nasal discharge and sneezing variables before and after phototherapy, demonstrated a decrease in the severity of the patients' symptoms.

In the current study, crustiness and dryness of the nose were the most frequent side effects noted by all patients.

Previously, UV light has been applied successfully to treat diseases of the nasal mucosa, but the effect of rhinophototherapy on nasal microbial flora was not known. Nasal flora is composed of numerous strains of aerobic bacteria that maintain a balance by coexistence and antagonism. Some researchers propose that failure to maintain this balance is one of the factors contributing to the spread of infectious diseases.[9,14]

The middle meatus plays a key role in the onset and persistence of infections in the nasal sinuses.[15,16] To identify novo bacteria, we compared nasal flora of the middle meatus of patients with symptomatic allergic rhinitis, swabbing both before and after intranasal

phototherapy.

Su et al.[16] found that *Staphylococcus epidermidis* and *corynebacteria* were the most frequent isolates from the nasal cavity of healthy subjects. Savolainen et al.[8] isolated 79 percent *Staphylococcus epidermidis*, 41 percent corynebacteria and 34 percent *Staphylococcus aureus*. Ylikoski et al.[17] isolated 72% *S. epidermidis*, 44% *Corynebacterium*, and 38% *S. aureus* from healthy young men. Douglas et al.[18] took endoscopically guided cultures from the middle meatus in normal subjects and found 64% positive cultures. İn another study, the researchers described the normal nasal flora as comprising certain bacterial species, including *Staplylococcus aureus*, *alpha* and *gamma streptococci*, *Staplylococcus epidermidis*, *Propionibacterium acnes* and *aerobic diphteroides.*[19]

Silva et al.[20] showed that in an atopic dermatitis patient, the effect of narrow-band ultraviolet B phototherapy may be attributable not only to reduction of bacteria on the skin surface but also to the suppression of superantigen production from *S. aureus*.

Leong SC[21] mentioned significant inter-individual variation for damage induction from intranasal treatment However; long-term side effects from regular intranasal treatment are unknown. Phototherapy treatment results in DNA damage but does not appear to predispose to carcinogenesis.

In all of our subjects, *Coagulase negative staphylococcus (CNS)* was the pathogen most frequently isolated from the nasal cavity both before and after intranasal phototherapy. Normal nasal microbial flora did not show any significant change.

The present study shows, for the first time, the effect of phototherapy on nasal microbial flora in patients with allergic rhinitis. Phototherapy is an effective modality in the treatment of allergic rhinitis, but future studies with larger groups of patients are needed to investigate the effect of intranasal phototherapy on the anaerobic flora on the nasal mucosa. This prospective, single blinded, self comparised study shows for the first time that intranasal phototherapy does not change the aerobic nasal microbial flora, but that intranasal phototherapy is an effective modality in treating the symptoms of patients with allergic rhinitis

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