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Original article

Comparison of the effects of nasal steroids and montelukast on olfactory functions in patients with allergic rhinitis☆

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ABSTRACT

Objective: Olfactory dysfunction is one of the comorbidities associated with allergic rhinitis (AR) and AR is one of the common causes of olfactory problems. We aimed to evaluate by the Sniffin' Sticks test the effects on olfactory functions of nasal steroids and leukotriene antagonists used for allergic rhinitis.
Methods: Thirty patients with seasonal rhinitis were included in this study. Patients were randomly divided into three groups of 10 patients; group 1 received montelukast sodium and mometasone furoate (MF) therapy, group 2 received only montelukast, and group 3 only MF. Patients' olfactory functions were determined using the Sniffin' Sticks olfactory test before and after a month treatment.
Results: Threshold, discrimination, identification, and the sum of threshold, discrimination, and identification (TDI) values were not significantly different among the groups before treatment. For Group 1 and Group 3 patients, there were statistically significant differences in threshold, discrimination, identification, and TDI values before and after treatment ($P < 0.05$) (Wilcoxon signed ranks analysis). For Group 2 patients, the before and after treatment values of threshold, discrimination, identification, and TDI showed no significant difference ($P > 0.05$).
Conclusion: According to the findings of our study, MF is superior to montelukast in improving olfactory function. Although montelukast has been shown to be effective against AR symptoms, its effect on olfactory function was not demonstrated in this study.

1. Introduction

Olfactory dysfunction is one of the comorbidities associated with allergic rhinitis (AR) [1–3], and AR is one of the common causes of olfactory problems [4]. Hyposmia is often neglected by patients and overlooked by physicians. Clinical studies have stated that 60% of patients with AR have olfactory abnormality even if they have no nasal polyps or septum deviation [5]. Olfactory disorders affect the quality of life and job performance of AR patients. Olfactory dysfunction in AR may be explained by obstruction of airflow to the olfactory cleft due to nasal mucosal swelling from inflammation [6–8]. However, it has been shown that the degree of airflow obstruction in AR is not directly linked with olfactory dysfunction [9–12]. Also, it has been shown that inflammatory mediators play an important role in olfactory dysfunction in AR patients [13,14].

Nasal steroids, antihistamines and immunotherapy are usually used for treatment of AR symptoms. It is recommended that montelukast is used, if AR is together with asthma in the patients. Although olfactory effects of nasal steroids, antihistamines, and immunotherapy have been demonstrated [15–17], leukotriene antagonists have not been thoroughly investigated to date. The Sniffin' Sticks olfactory test has been used to assess olfactory function in many studies related to AR. In this study, we aimed to evaluate by the Sniffin' Sticks test the effects on olfactory functions of nasal steroids and leukotriene antagonists used for AR.

2. Materials and methods

This was a prospective, randomized, parallel-group (three groups) study. The study was conducted in the Department of ENT Clinic of Gaziosmanpaşa-Taksim Training and Research Hospital. The Gaziosmanpaşa-TaksimTraining and Research Hospital Ethical Board approved the protocol and informed consent forms. Thirty patients (ages 18 to 65) with a clinical history of seasonal AR for at least 1 year were included in this study. This study was conducted during the pollinic season.

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2.1. Assessment of allergic rhinitis

AR was diagnosed using ARIA criteria: a positive skin test to grass and/or tree pollens in patients with clinical history of seasonal AR for at least 1 year [18]. Patients who had received drug treatment (corticosteroids, antihistamines, antidepressants, antihypertensive, etc) or immunotherapy before the study were excluded. Patients with asthma, deviated nasal septum, history of nasal operation, turbinate hypertrophy, nasal polyposis or chronic nasal disorders (Chronic sinusitis with or without polyps, fungal sinusitis, nasal masses, chronic nasal infections, etc), pregnancy, smoking or upper airway infections were also excluded. After a thorough ear, nose, and throat examination and nasal endoscopy, patients were randomly divided into three groups of 10 patients; group 1 received montelukast sodium (10 mg once daily) and mometasone furoate (MF) (200 μg/day) therapy, group 2 received only montelukast, and group 3 only MF.

2.2. Olfactory evaluation

Patients' olfactory functions were determined using the Sniffin' Sticks olfactory test. The test was performed (with both nostrils simultaneously) to obtain the TDI score (the sum of threshold, discrimination, and identification) for each patient.

Sniffin' Sticks is a validated test that examines olfactory threshold (n-butanol), discrimination, and identification with good test-retest reliability. Odorants were presented in commercially available felt-tip pens (Sniffin Sticks', Burghart GmbH, Wedel, Germany) [19]. For odor presentation, the pen cap was removed by the experimenter for approximately 3 s and the tip of the pen was placed approximately 1–2 cm in front of the nostrils. For odor thresholds, three pens were presented in a randomized order, one containing n-butanol in different dilutions (with an increasing dilution ratio of 1:2), and two containing the solvent. When the patient identified the pen with the odorant twice, the next lower concentration was presented, until the patient could not identify the pen with the odorant (scale of 1 to 16). This miss triggered a reversal of the staircase, so the pen with a one-step higher concentration was administered until the pen with the odorant was identified correctly. The test finished when seven reversals of the staircase had been found. The threshold is the mean of the last four reversals of the staircase. For identification, 16 common odorants were presented. To prevent olfactory desensitization, an interval of at least 30 s was maintained between exposures. Patients were asked to identify each odor on an odorant form by selecting four odorants, and correct answers were recorded. Odor discrimination was made using 16 triplets of odorant pens in which the odor in one pen differs from that of the other two.

The results of the TDI tests were considered separately and summarized in an overall TDI score. Results from olfactory testing can be analyzed separately from each other.

After 4 weeks of drug therapy, the Sniffin' Sticks test was applied again to assess olfactory function. Pre- and post-therapy results were compared among the three groups.

2.3. Statistical analysis

Statistical analysis of the data was performed using the SPSS 15.0 for Windows software. The Mann-Whitney U test was used for comparisons between the two groups, and the Kruskal-Wallis H test (Mann-Whitney U with post hoc Bonferroni correction) was used for comparisons between more than two groups, The Wilcoxon signed-ranks test was used for comparisons of data obtained before and after treatment. In post hoc tests $P < 0.10$ and in other analyses $P < 0.05$ were considered to indicate statistical significance.

Table 1
The ratio of age and sex in three groups.

Group	Sex	*n*	%	Age		*P*[a]
				Mean ± SD	Min.–Max.	
Group 1	Male	3	30	25.33 ± 7.57	20–34	0.425
	Female	7	70	30.71 ± 7.91	18–41	
	Total	10	32.3	29.1 ± 7.82	18–41	
Group 2	Male	3	30	29.67 ± 11.5	18–41	0.909
	Female	7	70	27.86 ± 9.82	19–42	
	Total	10	32.3	28.4 ± 9.72	18–42	
Group 3	Male	1	9.1	60	60–60	0.096
	Female	10	90.9	32.5 ± 6.19	23–43	
	Total	11	35.5	35 ± 10.16	23–60	
Total	Male	7	22.6	32.14 ± 14.79	18–60	0.849
	Female	24	77.4	30.63 ± 7.77	18–43	
	Total	31	100	30.97 ± 9.51	18–60	

[a] Mann-Whitney U analysis.

3. Results

There was no statistically significant difference in the age and sex of the patients among the three groups (Table 1) ($P = 0.849 > 0.05$). Threshold, discrimination, identification, and TDI values were not significantly different among the groups before treatment. For Group 1 and Group 3 patients, there were statistically significant differences in threshold, discrimination, identification, and TDI values before and after treatment ($P < 0.05$) (Wilcoxon signed ranks analysis) (Tables 2 and 3). For Group 2 patients, the before and after treatment values of threshold, discrimination, identification, and TDI showed no significant differences (Table 3) ($P > 0.05$).

4. Discussion

The most widely drugs used in AR treatment are nasal steroids, antihistamines, and the montelukast group of drugs [18,20,21]. These drugs have been shown to reduce inflammation in the allergic nasal mucosa and to increase the patient's quality of life. One of the important symptoms in patients with AR is hyposmia or olfactory dysfunction [12]. When we reviewed the effect of various treatments on olfactory dysfunction in patients with AR, we found reports in the literature indicating that intranasal steroids, antihistamines, and immunotherapy increase olfactory function [12,15].

We determined olfactory function using the Sniffin' Sticks test. The Sniffin' Sticks test is a convenient and reliable method for determining olfactory dysfunction. The Sniffin' Sticks test has been suggested and widely accepted as a standard test. It has been used to quantitatively evaluate olfactory functions by measuring TDI, identification, and threshold values. Although the test results may be affected by various factors such as age, sex, environmental factors, smoking, and the person who conducts the test, use of this test has become popular. We used the Sniffin' Sticks test for this study because it provides a quantitative assessment of olfactory function in patients with AR.

In patients with AR, there are studies on the use of MF to treat olfactory dysfunction [12,16]. MF has been shown to reduce inflammation and to improve the smell function by increasing nasal airflow and decreasing inflammation of the olfactory region [12]. However, the mechanism for these effects is unknown. Although obstruction of airflow to the olfactory cleft secondary to nasal mucosal swelling from inflammation may contribute to loss of olfaction in AR, the normal cyclic variations in the nasal cycle are not associated with olfactory loss [7,8,12]. Additionally, treatment that improves symptoms of obstruction and reduces nasal edema can fail to improve hyposmia. Studies have suggested that intranasal corticosteroids may be effective in improving olfactory loss in AR.

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