

The effects of phototherapy on quality of life in allergic rhinitis cases

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Abstract Phototherapy, using a combination of UV-A (25%), UV-B (5%) and visible light (70%), is known to be effective in suppressing the clinical symptoms of allergic rhinitis significantly. It has also been shown that phototherapy locally reduces the number of inflammatory cells and the level of mediators. We aimed to investigate the efficacy of phototherapy in improving the quality of life of patients with allergic rhinitis using Rhinoconjunctivitis Quality of Life Questionnaire, besides checking the total symptom scores of 100 consecutive cases. When the previous and after treatment data were compared, statistically significant differences were found in all quality of life variables ($P < 0.001$). These results suggest that phototherapy is an effective method to relieve symptoms of allergic rhinitis and has a positive effect on the quality of life of allergic patients. Further studies are needed to plan an ongoing treatment of phototherapy at certain intervals for continuous relief of symptoms and a better and longstanding quality of life.

Keywords Allergic rhinitis · Phototherapy · UV light · RQLQ · Rhinoconjunctivitis Quality of Life Questionnaire · Quality of life

Introduction

Phototherapy has a profound immunosuppressive effect, and phototherapeutic methods using both UV and visible light are therefore widely used for the therapy of various inflammatory skin diseases [1]. It is also proposed that phototherapy, using a combination of UV-A (25%), UV-B (5%) and visible light (70%), may represent a therapeutic alternative to patients with allergic rhinitis. Various studies on the successful results of phototherapy treatment on allergic symptoms have been published [1–5]. Koreck et al. [2] assessed the efficacy of phototherapy in allergic rhinitis and stated that phototherapy locally reduced the number of inflammatory cells. They also revealed that UVAB significantly suppressed the clinical symptoms of allergic rhinitis.

The Rhinoconjunctivitis Quality of Life Questionnaire (RQLQ) was developed to measure the functional problems (physical, emotional, social and occupational) that are most troublesome to adults (17–70 years) with either seasonal or perennial rhinoconjunctivitis of either allergic or non-allergic origin [6]. Many studies were carried out in order to develop, standardize and validate the questionnaire for uses in clinical trials [7–11]. Another advantage of using RQLQ is that it has been translated to Turkish recently and validity and reliability tests have been performed.

Herein, we aimed to investigate the efficacy of phototherapy treatment on patients with allergic rhinitis by means of the clinical findings, total nasal symptom score (TNSS) and RQLQ.

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Materials and methods

Study design

We conducted a prospective study in 100 patients with a history of at least 2 years of moderate to severe allergic rhinitis that was not controlled by anti-allergic drugs. Positive skin test results confirmed the diagnosis. The study was performed out of the pollen season. The study protocol was approved by the ethics committee of the university and a written consent form was obtained for each volunteer (Approval No. 31.12.2007-43). The patients were provided the necessary information on the nature and scope of the clinical study. All participants were required to submit a signed informed consent form at least 24 h before the start of treatment. As much as 34 patients were enrolled in the control group. Volunteers with significant nasal structural abnormalities, asthma, an upper or lower respiratory tract infection within 4 weeks or nasopharyngeal pathology diagnosed via fiberoptic endoscopy, and those who had used any of the following drugs: systemic corticosteroids within 4 weeks, topical corticosteroids within 2 weeks, membrane stabilizers within 2 weeks, antihistamines within 1 week, nasal decongestants within 3 days or immunotherapy within 5 years before the beginning of the study were excluded from the study. A total of 100 patients were assigned to receive UVAB, which was composed of UV-A (25%), UV-B (5%) and visible light (70%), in the phototherapy group. Illuminations were performed with the same device (Rhinolight III; Rhinolight Ltd, Szeged, Hungary; range 310–600 nm) and by the same examiner. Each intra-nasal cavity was irradiated three times a week for 2 weeks with increasing doses as shown in Table 1. During the course of the investigation, no rescue medication was allowed. The signs and symptoms of allergic rhinitis were

scored jointly by the investigator and the volunteer before and after the treatment.

Assessing the efficacy of treatment

The signs and symptoms of allergic rhinitis were scored jointly by the investigator and the volunteer. The efficacy of treatment was assessed with clinical findings, TNSS and RQLQ.

The same physicians recorded the clinical findings of lower turbinate color and turbinate congestion before and after the treatment. Rating scales from 0 to 3 were used, with defined criteria to assign the appropriate rating, such as 0 = none, 1 = mild, 2 = moderate and 3 = severe.

TNSS is the sum of the scores for the four nasal symptoms that graded the patient before and after the treatment. Nasal symptoms included in the study were nasal obstruction, nasal itching, nasal discharge and sneezing. All symptoms were graded on a four-point scale using the following system: 0 = none, 1 = mild (symptoms that are present, but not particularly bothersome), 2 = moderate (symptoms that are bothersome, but do not interfere with daily activities), and 3 = severe (symptoms that are bothersome and interfere with daily activities or disturb sleep). TNSS, which is considered as the most common and best established parameter for the clinical assessment of allergic rhinitis, was also calculated.

The quality of life was assessed at the first visit and on the first and the third months at the end of treatment using the RQLQ. The RQLQ has 28 questions in seven domains (activity limitation, sleep problems, nose symptoms, eye symptoms, non-nose/eye symptoms, practical problems and emotional function). There are three “patient-specific” questions in the activity domain that allow patients to select three activities in which they are most limited by their rhinoconjunctivitis. Patients recall how bothered they have been by their rhinoconjunctivitis during the previous week and respond to each question on a seven-point scale (0 = not impaired at all; 6 = severely impaired). The overall RQLQ score is the mean of all 28 responses and the individual domain scores are the means of the items in those domains [9].

Statistical analyses

Data were analyzed using the SPSS (Statistical Package for Social Sciences) 13.0 for Windows and Sigmastat 3.1. The distribution of variables was checked initially by Shapiro-Wilk test. Parametric tests were applied to data showing normal distribution, whereas nonparametric tests were applied to data showing non-normal distribution. Chi square test was used to compare the sex and age distributions of the patients. Comparison of age distribution of groups was performed using independent samples *t* test. The difference in the diaries

Table 1 The treatment protocol used for the illumination of the patients' nasal cavities either with UVAB or placebo light

| Number of treatments made with UVAB | Length of treatments per nostril (min:s) |
|-------------------------------------|--|
| First week | |
| 1. | 2:00 |
| 2. | 2:15 |
| 3. | 2:30 |
| Second week | |
| 4. | 2:45 |
| 5. | 3:00 |
| 6. | 3:00 |

Two minute as the starting dose is equal to 1.6 J/cm^2 . At every consecutive treatment, the dose was raised by 0.2 J/cm^2 ; therefore, the top dose was 2.4 J/cm^2 and this was achieved at the fifth treatment session. Source: Rhinolight Ltd

kept by the groups was compared by repeated measures of ANOVA. The initial symptoms of cases such as nasal discharge, sneezing, nasal congestion and itching were compared using Mann–Whitney *U* test. The variation in these symptoms and physical findings during the treatment period were compared by Wilcoxon signed ranks test. Results were expressed as mean \pm SD and a *P* value <0.05 was considered to be statistically significant.

Results

Demographics

The study population consisted of 69 female and 31 male volunteers, with a mean age of 35.09 years (range 18–52 years) (Table 2).

Patient symptom and physical examination scores

Marginal homogeneity test was used to determine the consistency between the patients' symptom scores and the physical examination scores, before the treatment and in the first and the third months after the end of the treatment. A statistically significant difference was found between the scores of “nasal discharge, nasal obstruction, sneezing, nasal itching and turbinate edema” before and after surgery ($P < 0.001^{***}$). However, no statistically significant difference was found between these scores for the two post-treatment examinations ($P > 0.05$).

Rhinoconjunctivitis Quality of Life Questionnaire

Our data of three consecutive RQLQ were grouped according to the following seven domains, namely sleep (three items), non-nasal eye symptoms (seven items), practical problems (three items), nasal symptoms (four items), eye symptoms (four items), activities that have been limited by nose or eye symptoms (three items) and emotional function (four items), and compared statistically.

Statistically significant differences were found in the average results of the RQLQ item describing “Activities that have been limited by nose or eye symptoms”. Differences between pre- and post-treatment results were statisti-

Table 2 Distribution of patients according to age and sex

| Age | Sex | | Total |
|-------|-----|----|-------|
| | F | M | |
| 18–29 | 22 | 12 | 34 |
| 30–41 | 26 | 8 | 34 |
| 42+ | 21 | 11 | 32 |
| Total | 69 | 31 | 100 |

cally significant ($P < 0.05$). Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 1).

Patients' activity limitations due to allergies are listed in Table 3. The list consists of activities that are specific to the patient's lifestyle and conditions. Statistically significant differences were found in the “Sleep” average results. Differences between pre- and post-treatment results were statistically significant ($P < 0.05$). Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 2). Statistically significant differences were found in the “Non-nasal eye symptoms” average results. Differences between pre- and post-treatment results were statistically significant ($P < 0.05$). Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 3). Statistically

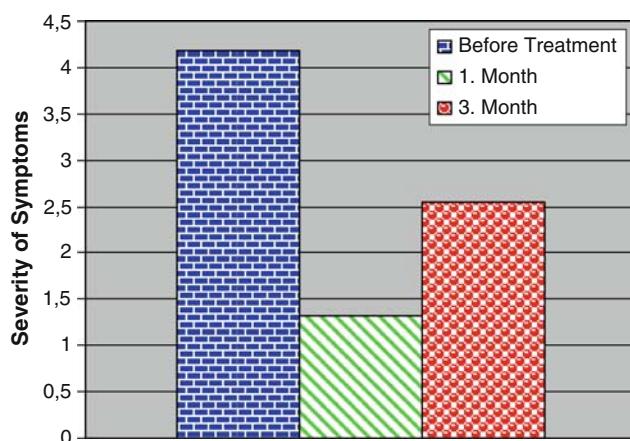
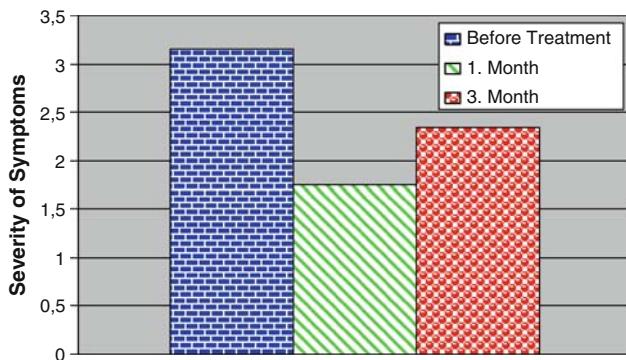
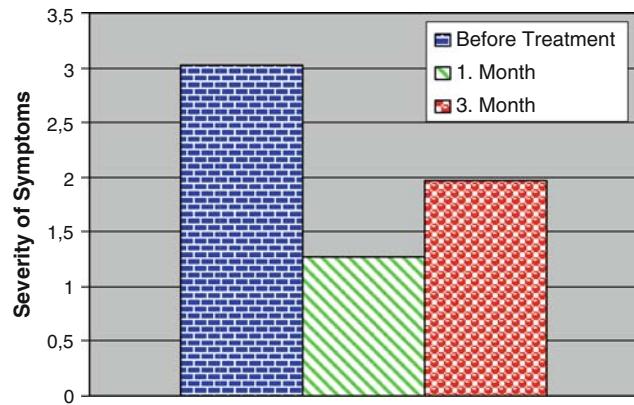
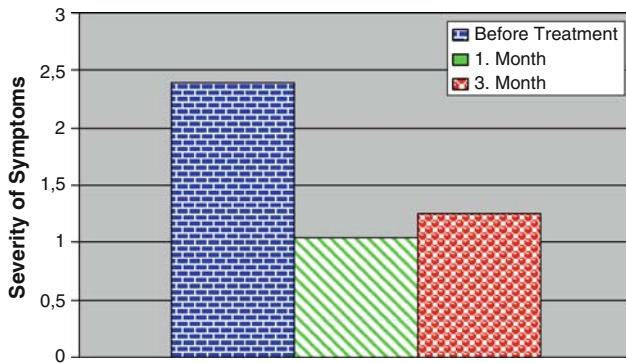
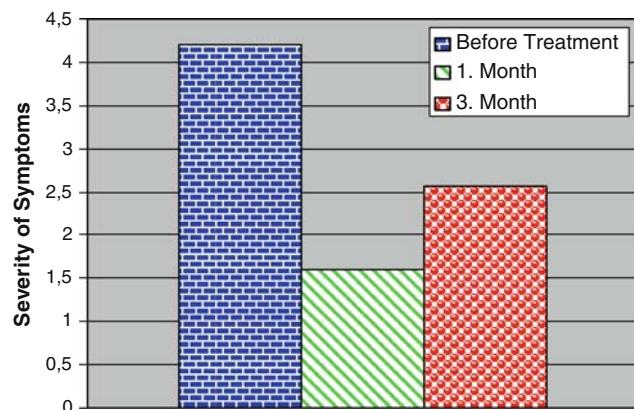
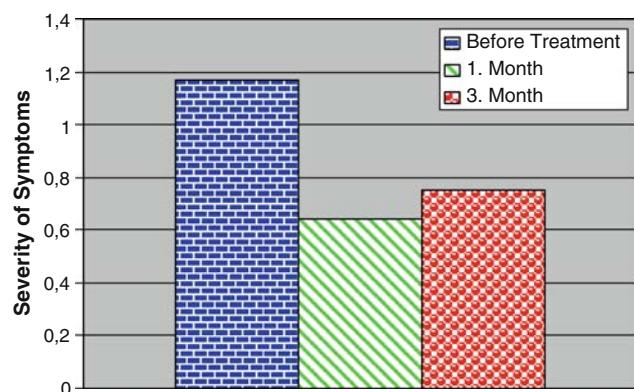


Fig. 1 RQLQ “Activities that have been limited by nose or eye symptoms” average results

Table 3 Activity limitations and their distribution according to patients

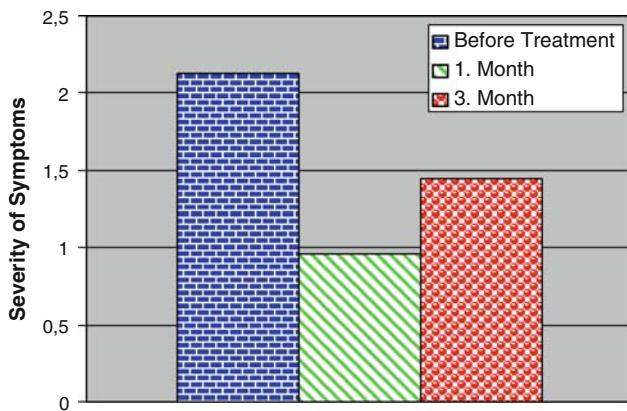
| Activity limitations | Number of patients | Percentage |
|----------------------------------|--------------------|------------|
| 1 Eating | 9 | 3 |
| 2 Talking | 10 | 3.3 |
| 3 Driving | 12 | 4 |
| 4 Playing with children | 13 | 4.3 |
| 5 Visiting friends and relatives | 17 | 5.6 |
| 6 Going for a walk | 22 | 7.3 |
| 7 Work-related activities | 25 | 8.3 |
| 8 Exercising or workout | 30 | 10 |
| 9 Outdoor activities | 33 | 11 |
| 10 Sports | 38 | 12.6 |
| 11 Vacuuming | 39 | 13 |
| 12 Housework | 52 | 17.3 |
| | 300 | 100 |

**Fig. 2** RQLQ “Sleep” domain average results**Fig. 4** RQLQ “Practical problems” average results**Fig. 3** RQLQ “Non-nasal/eye symptoms” average results**Fig. 5** RQLQ “Nasal symptoms” average results**Fig. 6** RQLQ “Eye symptoms” average results

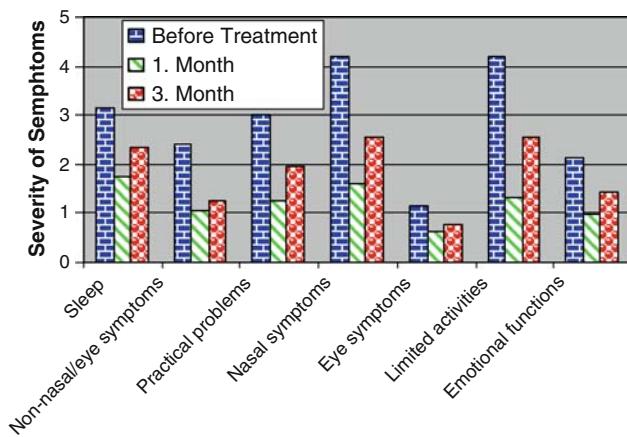
significant differences were found in the “*Practical problems*” average results. Differences between pre- and post-treatment results were statistically significant ($P < 0.05$), Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 4). Statistically significant differences were found in the “*Nasal symptoms*” average results. Differences between pre- and post-treatment results were statistically significant ($P < 0.05$), Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 5). Statistically significant differences were found in the “*Eye symptoms*” average results. Differences between pre- and post-treatment results were statistically significant ($P < 0.05$). Differences between post-treatment results in the first and third months were not found to be statistically significant ($P < 0.05$) (Fig. 6). Statistically significant differences were found in the “*Emotional function*” average results. Differences between pre- and post-treatment results following the treatment were statistically significant ($P < 0.05$). Differences between post-treatment results in the first and third months were also found to be statistically significant ($P < 0.05$) (Fig. 7). All the variables in the RQLQ are shown in Table 4 and Fig. 8.

No statistical correlation was found between gender and RQLQ variable results (activities, sleep, symptoms that are not nasal/ocular, general problems, nasal symptoms, ocular symptoms, emotions) ($P > 0.05$).

Also, no statistical correlation was found between age and RQLQ variable results (activities, sleep, symptoms that are not nasal/ocular, general problems, nasal symptoms, ocular symptoms, emotions) ($P > 0.05$).

**Fig. 7** RQLQ “Emotional function” average results**Table 4** Average results of all variables in the RQLQ, grouped as pre-treatment, 1st month after treatment and 3rd month after treatment

| | Pre-treatment | After 1 month | After 3 months |
|------------------------|---------------|---------------|----------------|
| Limited activities | 4,183 | 1,326 | 2,553 |
| Sleep | 3,153 | 1,746 | 2,336 |
| Non-hay fever symptoms | 2,398 | 1,045 | 1,247 |
| Practical problems | 3,016 | 1,266 | 1,973 |
| Nasal symptoms | 4,197 | 1,6 | 2,56 |
| Eye symptoms | 1,17 | 0,64 | 0,752 |
| Emotional functions | 2,13 | 0,962 | 1,445 |

**Fig. 8** Average results of all variables of the RQLQ, grouped as pre-treatment, 1st month after treatment and 3rd month after treatment

Discussion

Allergic rhinitis is considered as a very important disorder due to its high incidence and severe impairment of quality of life. There are numerous research papers that deal with the assessment of various drugs on health-related quality of

life of allergic cases. When medical therapy is in question, it makes sense to focus only on aiming to eliminate mortality and cure the disease. But recently it has become an equally important concern to improve the patients’ well-being, a fact which is one of the underlying motives of this study concerned with allergic rhinitis and quality of life. In some medical therapies, the relief of symptoms is the natural consequence of treatment. In the case of allergic rhinitis, however, the aim is to reduce the severity of symptoms rather than treat the disease. The first step to successful management is the accurate diagnosis of the type of AR (intermittent or persistent) and assessment of its severity (mild or moderate to severe). The results of the allergen avoidance studies for perennial allergic rhinitis indicate that, when compared with controls, significant reductions of allergen load can be achieved by physical and chemical means, but there is little evidence at present that these reductions translate into sustained improvements in clinical outcomes [13]. Whereas, there are studies that deal with the correlation of atmospheric pollens with common allergens determined by prick testing of a certain region [14]. It is known that symptoms of allergic rhinitis due to mites are related to the environmental mite level in places where the patients live. The relationship between mite levels and symptoms of allergic rhinitis-diagnosed patients, and the change of mite levels in the environment after appropriate education is shown in previous studies [15]. As minimal medical intervention is universally desirable, many pharmacological approaches were described. But, intranasal steroids and antihistamines are the gold standard of medical therapy [16]. There are many patients who do not desire to take any medication for the relief of allergic rhinitis, or these medications may be contraindicated due to various reasons. A treatment application like phototherapy may be very suitable, especially in such cases that commonly used drugs that are contraindicated and/or have insufficient efficacy. Furthermore, not using any medication may also be an additional positive effect on their quality of life.

Health-related quality of life instruments are easy to use and may provide an acceptable means of obtaining a formalized and quantitative patient history. Theoretically, the patient can complete the questionnaire in the waiting room and a quick scan of responses by the clinician might reduce consultation time and allow the clinician to quickly focus on areas of interest to the patient. Further, questionnaires may reveal problems not spontaneously volunteered by patients, particularly children. So a questionnaire may prevent misdiagnosis in the patient. This is another advantage of using a questionnaire like the RQLQ. The RQLQ was designed specifically to evaluate the quality of life in adults by asking patients to identify those items that were most troublesome to them. Although SF36 is a well-known

general health questionnaire, RQLQ carries the advantage of being specific to rhinoconjunctivitis [12]. The final 28-item RQLQ covers the following seven domains: sleep, non-nasal/eye symptoms, practical problems, nasal symptoms, eye symptoms, activities that have been limited by nose or eye symptoms and emotional function [7]. Each of these very important domains were evaluated and statistically compared individually. When the pre- and post-treatment data were compared, statistically significant difference was found at all QOL variables ($P < 0.001$). Our results demonstrating consistency among different domains can be interpreted as the success of the questionnaire, or the uniformity of our cases due to similar cultural and social background of the patients.

A statistically significant difference was found between all variables, including the TNSS, in the phototherapy group before and after the treatment. The results from the phototherapy group were better than the control group ($P < 0.001$). Global evaluation of the domains of RQLQ of our patients with nasal and ocular allergies suggested that phototherapy was an effective treatment for improving the quality of life. Most evident improvements are in nasal symptoms, activity limitations and sleep parameters. However, ocular symptoms and non-allergic symptoms are the ones that show only minor improvements.

Our data reveal that the efficacy of phototherapy in allergy was higher at the end of the first month when compared with the results at the end of the third month. These data suggest that an additional phototherapy treatment may be scheduled at certain intervals.

Conclusion

This study demonstrates that phototherapy is an effective modality in the treatment of allergic rhinitis and has positive effect on the quality of life of patients, especially in cases for which commonly used drugs are contraindicated and/or have insufficient efficacy. Further studies are needed to plan an ongoing treatment of phototherapy at certain intervals for continuous relief of symptoms and a better and longstanding quality of life.

Conflict of interest We do not have a financial relationship with any organization or any company. Nobody sponsored the research.

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