Short Communication

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Immunotherapy

The effectiveness of sublingual immunotherapy for house dust mite-induced allergic rhinitis and its co-morbid conditions

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Aim: We investigated sublingual immunotherapy for mite-induced allergic rhinitis and its comorbid allergic conditions. **Patients & methods:** A prospective case-controlled study of 120 patients (case = 80, control = 40) over 12 months. **Results:** There was 53.6% reduction in total rhinitis symptom score ($p < 0.0001$), but not in controls (-7.3%, $p = 0.99$). The total symptom scores for concurrent asthma decreased from 17.79 to 8.8 ($p < 0.0001$); for allergic conjunctivitis from 20.89 to 10.0 ($p = 0.0002$); for atopic dermatitis from 46.40 to 29.38 ($p = 0.0004$) and 74.6% of patients weaned off nasal topical steroids. The treatment-related adverse reactions were mild and self-limiting. **Conclusion:** Though sublingual immunotherapy may be more expensive than conventional treatments, it was an adjunctive therapy that improved not only the outcomes for allergic rhinitis, but also its comorbid allergic conditions.

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Keywords: allergic rhinitis • asthma • atopic dermatitis • conjunctivitis • eczema • effectiveness • immunotherapy • mite • sublingual

Co-existence of allergic diseases is common in clinical practice. This was highlighted and quantified in some recent meta-analyses [1–3]. However, literature on the effectiveness of allergen immunotherapy (AIT) for allergic rhinitis and the concurrent effect for their comorbid allergic conditions is relatively scarce [4].

Substantial clinical evidence is available to support the use of AIT for patients with allergic rhinitis [5]. Some recent guidelines even suggest that AIT should be considered as the first-line treatment for allergic rhinitis [6]. AIT is the unique disease modifying treatment strategy for allergic diseases [7]. It is well documented in multiple meta-analyses that the immunomodulatory effect can result in long term remission which can last for more than 10 years after treatment has stopped [8–10]. Moreover, AIT has been shown to prevent asthma development and new allergen sensitization in allergic rhinitis patients [11,12]. Recently, the preventive role of AIT introduced at an early age is also being investigated [13].

The underlying mechanism of AIT has been intensively studied and now we understand that it modifies a complex cascade of immune responses at both molecular and cellular levels. These changes that occur during the course of AIT can be categorized into four stages. Stage one: a decrease in mast cell and basophil activity and degranulation is observed within a few hours after AIT. Stage two: allergen-specific Treg and Breg cells are produced within a few days leading to the suppression of allergen-specific effector T cells. Stage three: allergen-specific antibodies IgE to IgG4 ratio decreases substantially in the following few weeks to months. Stage four: decrease in the number of tissue effector cells including mast cells and eosinophils, and decreased in the amount of their mediators in target tissue are observed several months after the start of AIT [14].

There are two types of AIT commonly used for allergic rhinitis, namely sublingual or subcutaneous immunotherapy. Allergen-specific sublingual immunotherapy (SLIT) is more acceptable for the pediatric population as it is less invasive and does not require repeated injections. According to International Study of Asthma and Allergies in Childhood, the prevalence of rhinoconjunctivitis in Hong Kong was 15% among school children aged 9–11 years, which was significantly more common than in Beijing (6.4%) and Guangzhou (7.4%) [15]. Allergic rhinitis

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Table 1. Baseline demographic characteristics for sublingual immunotherapy and control groups.

	SLIT group N = 80	Control group N = 40	Chi-squared test/*t*-test p-value
Age			
Mean (SD)	14.3 (10.14)	13.3 (12.27)	0.62
Range	5–52	5–56	
Gender			
Males	52 (65%)	26 (65%)	1.0
Females	28 (35%)	14 (35%)	
Family history			
Yes	47 (58.75%)	30 (75%)	0.12
No	33 (41.25%)	10 (25%)	
Concurrent asthma			
Yes	26 (32.5%)	9 (22.5%)	0.36
No	54 (67.5%)	31 (77.5%)	
Concurrent allergic conjunctivitis			
Yes	39 (48.75%)	17 (42.5%)	0.65
No	41 (51.25%)	23 (57.5%)	
Concurrent atopic dermatitis			
Yes	21 (26.25%)	11 (27.5%)	1.0
No	59 (73.75%)	29 (72.5%)	
Concurrent food allergy			
Yes	7 (8.75%)	9 (22.5%)	0.07
No	73 (91.25%)	31 (77.5%)	

SLIT: Sublingual immunotherapy.

Table 2. Changes of total symptom scores for allergic rhinitis, asthma, allergic conjunctivitis and atopic dermatitis.

	SLIT					Control					Median difference SLIT vs control
	N	Mean at baseline	Mean at 12-month	Mean reduction (SD)/median	Wilcoxon Signed Rank test p-value	N	Mean at baseline	Mean at 12-month	Mean reduction (SD)/median	Wilcoxon Signed Rank test p-value	Wilcoxon Rank Sum test p-value
Allergic rhinitis	80	22.0	10.20	-11.80 (7.23)/-11	<0.0001	40	19.70	18.30	-1.40 (9.32)/0	0.9932	<0.0001
Asthma	19	17.79	8.80	-8.99 (7.92)/-7	0.0001	10	16.90	15.10	-1.80 (8.57)/-2.5	0.4733	0.0406
Allergic conjunctivitis	18	20.89	10.0	-10.89 (5.97)/-9	0.0002	11	8.09	9.09	1.0 (5.33)/-1	0.9177	<0.0001
Atopic dermatitis (SCORAD)	21	46.40	29.38	-17.02 (14.88)/-18.3	0.0004	10	33.20	24.97	-8.23 (17.59)/0	0.6241	0.0298

Wilcoxon Signed Rank tests are used to test the significance of changes from baseline to 12 month within SLIT and control groups. Wilcoxon Rank Sum test is used to test the significance of such changes between SLIT and control groups.
SLIT: Sublingual immunotherapy.

is usually characterized by recurrent episodes of sneezing, rhinorrhea, nasal congestion and pruritus. Moreover, the persistent and recurrent nature of this disease accounts for long term impairment in quality of life for sufferers [16]. Though allergic rhinitis is not an immediate life threatening disease, the associated comorbidities such as asthma, atopic dermatitis, conjunctivitis, sinusitis, nasal polyposis, upper respiratory infections, otitis media, sleep disorders, learning impairments have led to enormous healthcare expenditures [17–19]. Among common triggers for allergic rhinitis, house dust mite (HDM) was found to be most prevalent in patients with rhinitis and asthma in China [20]. And the commonest subtypes of HDM sensitization were Dermatophagoides pteronyssinus (Dp) and Dermatophagoides farinae (Df) [21].

Patients & methods

To assess the effectiveness of SLIT on HDM-induced perennial allergic rhinitis and its comorbid allergic conditions, we conducted a prospective case–control study in two tertiary referral centers for allergic diseases in Hong Kong from January 2016 to December 2017. The study was approved by the research committee of Hong Kong Sanatorium & Hospital and complied with the principles of the Declaration of Helsinki. It has been registered in the ISRCTN registry (Identifier ISRCTN32263767). Patients suffering from physician-diagnosed perennial

allergic rhinitis according to ARIA guidelines [22], with a positive specific serum IgE level of ≥3.5 kU/l or a positive skin prick test reaction to one or both Dp and Df extracts of ≥3 mm compared with diluent control were consecutively enrolled. Cases were defined as patients suffering from HDM-induced perennial allergic rhinitis who had unsatisfactory response to pharmacological treatment and received SLIT with allergen extract (SLITone Ultra® HDM ALK-Abellò) for 12 months. Controls were defined as age- and sex-matched patients who were never treated with SLIT for personal financial reasons. The cost of SLITone Ultra HDM was fully paid by patients who received it. All cases received SLIT according to the nonrush daily schedule as recommended by ALK-Abellò. The major allergen content of SLITone Ultra HDM used in our study consists of Der p1 14.5 ± 1.0 μg/ml; Der f1 6.2 ± 1.8 μg/ml and (Der p2 + Der f2) 1.5 ± 0.2 μg/ml by quantitative MARIA® assay [23]. The first administration was performed in the designated center under direct medical supervision, and subsequent daily doses were given at home. The home therapy for pediatric subjects (5–12 years) were given under the direct supervision of a trained adult family member. Conventional medications were prescribed for symptom control as necessary in all participants. The severity of their nasal symptoms and the comorbid conditions were recorded at baseline and at 12 month using the standardized questionnaire (Appendix A) with reference to European Medicines Agency guidelines. Symptom scores for allergic rhinitis, asthma, allergic conjunctivitis and eczema were assessed using a visual analog scale for each symptom recorded by the patient making a handwritten mark on a 10-cm line that represented 'no symptom' to 'worst symptom'. The symptom scores of rhinorrhea, nasal congestion, sneezing and nasal itchiness were assessed for allergic rhinitis; the scores of cough, shortness of breath, wheezing and sleep awakening for asthma; and SCORAD score for eczema, respectively [24]. The primary outcomes were the change of symptom and medication scores of allergic rhinitis, and the symptom scores of concurrent asthma, allergic conjunctivitis and atopic dermatitis before and at the end of the 12-month study period. The medication usage including antihistamines and nasal topical steroids were also recorded. The main antihistamines used were cetirizine and/or bilastine for adult patients, and cetirizine and/or fexofenadine for patients under 18 years of age in both the SLIT and control groups. The nasal topical steroids were either fluticasone furoate or mometasone furoate for adult and pediatric patients in both groups. Any treatment-related adverse event during the study period was documented according to AIT systemic allergic reaction grading system recommended by World Allergy Organization [25]. All patients in both case and control groups had regular follow-up visits every 3 months. Both doctors and nurses reminded patients to take their medications between follow-up visits.

Concerning the symptom score changes in allergic rhinitis with SLIT, it was assumed that the changes of total symptom score of allergic rhinitis were 8 (reduced 2 for each individual symptom) with standard deviation of 12. For Wilcoxon Signed Rank test with 80% power and 5% significance level, at least 21 samples were required. Sample size was calculated by G*Power Version 3.1.2 [26].

Summary statistics were used to summarize baseline information and symptoms. χ^2 test, *t*-test, Wilcoxon Signed Rank test as well as Wilcoxon Rank Sum test were conducted to examine the differences between groups. McNemar's test was performed to analyze medication usage. All analyses were compared two-tailed with statistical significance set at $p < 0.05$. All statistical analyses were computed by R 3.6.0 [27].

Results

A total of 120 patients were evaluated in the case (n = 80) and control (n = 40) groups. Their demographic and clinical characteristics are summarized in Table 1. The two populations were comparable with no significant statistical difference. The mean ages were 14.3 and 13.3 years old, respectively, in the cases and controls, ranging from 5 to 52 years of age in the SLIT group, and 5 to 56 years of age in the control group. About two third of cases and controls were male gender. More than half in both groups had a family history of atopy. Comorbidities including concurrent asthma, allergic conjunctivitis, atopic dermatitis and food allergy were commonly seen in both groups. Asthma was present in 32.5% of cases and 22.5% of controls. About half of cases and over 40% of controls were suffering from allergic conjunctivitis. About a quarter of cases and controls were diagnosed with atopic dermatitis. Concomitant food allergy was found in 8.75% of cases and 22.5% of controls, respectively, but this difference was not statistically significant (p = 0.07).

Following 12 months of SLIT, there was a significant reduction in the total rhinitis symptom scores from mean 22.0 to 10.2 (-53.6%, $p < 0.0001$), while no significant change was observed in the control group (from 19.7 to 18.3, -7.3%, p = 0.99) (Table 2). All individual symptom scores of allergic rhinitis (including rhinorrhea, nasal congestion, sneezing and nasal itchiness) showed >50% reductions in patients of the SLIT group ($p < 0.0001$) but not in the control group (Figure 1). The mean duration of the symptomatic period was reduced by half

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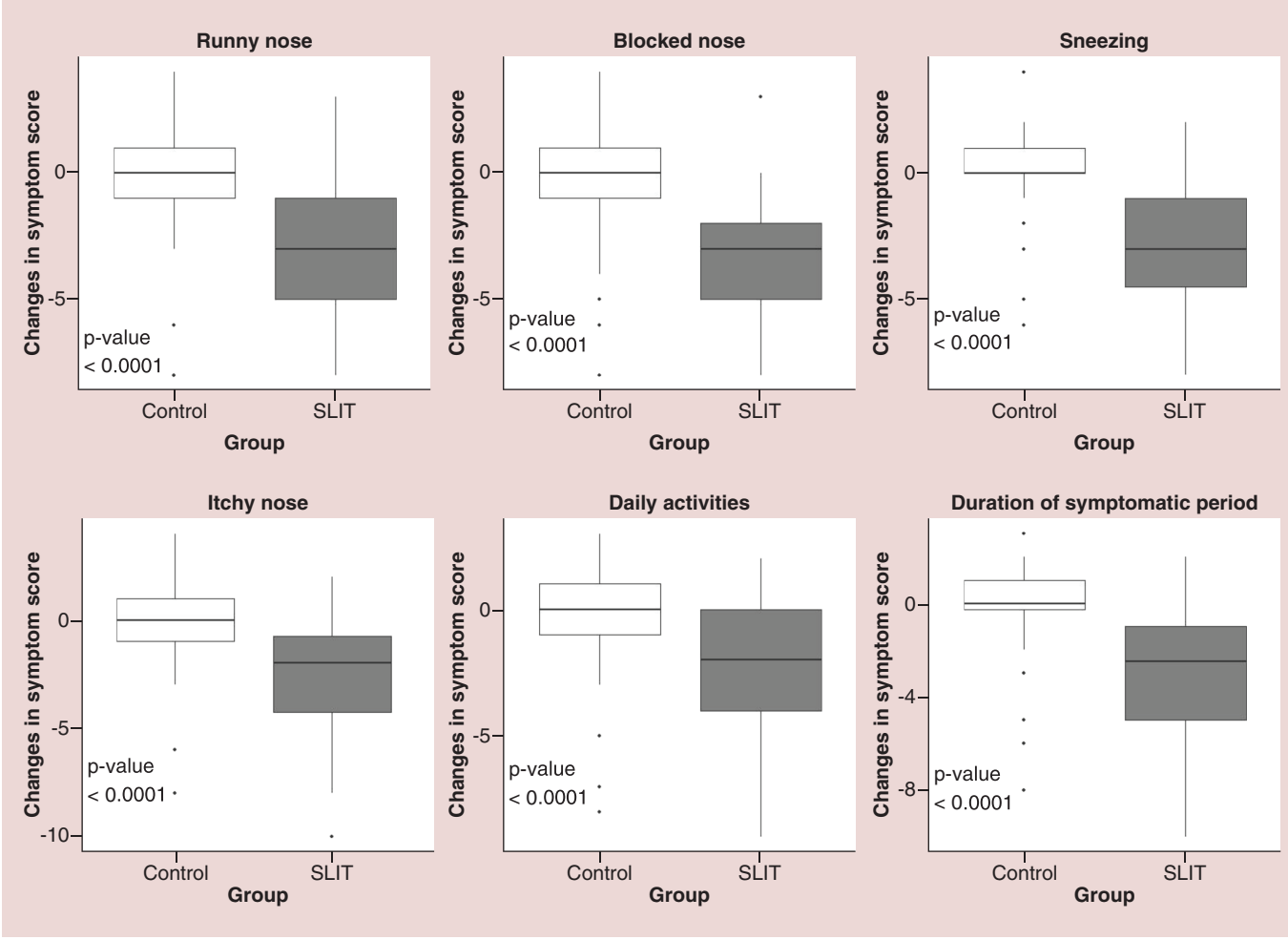

Figure 1. Boxplots of the differences in individual rhinitis symptom scores. The difference is the change of symptom scores from baseline to 12 months. The results from the group receiving sublingual immunotherapy and the controls are shaded and unshaded, respectively. The upper band of the box is the upper quartile, the middle band is the median and the lower band is the lower quartile. The upper vertical line connects the highest datum within 1.5 inter-quartile range (difference between upper and lower quartile) of the upper quartile to the box. The lower vertical line connects the lowest datum within 1.5 inter-quartile range of the lower quartile to the box. Unconnected points outside the box are outliers. p-values are from Wilcoxon Rank Sum tests.

($p < 0.0001$) and there was a significant decrease in the disease-related effect on activities of daily living in patients of the SLIT group ($p < 0.0001$), but no significant difference was found in the controls ($p = 0.71$ & $p = 0.96$).

For nasal steroids usage, 83.8% of patients in the SLIT group were using them at enrollment, but only 21.3% were still using it by the end of the study period, so three quarters of them had successfully weaned off nasal topical steroids in 12 months ($p < 0.0001$). In contrast for controls, the use of nasal topical steroids was increased from 47.5% to 87.5% over the study period ($p = 0.0002$). Nearly all patients required the use of antihistamines for symptom control at the start of the study (98% for SLIT group and 100% for controls), but half of the SLIT group were able to wean off antihistamines by the end of study period (decreased from 98% to 49%, $p < 0.0001$), where 98% of patients in the control group still required them regularly ($p = 0.3173$).

The total symptom scores of concurrent allergic diseases decreased from 17.79 to 8.80 ($p < 0.0001$) for asthma; from 20.89 to 10.0 ($p = 0.0002$) for allergic conjunctivitis; and the SCORAD from 46.40 to 29.38 ($p = 0.0004$) for atopic dermatitis in the SLIT group. While in the control group, there was no significant change from 19.70 to 18.30 ($p = 0.99$) for asthma, from 8.09 to 9.09 ($p = 0.92$) for allergic conjunctivitis and from 33.20 to 24.97 ($p = 0.62$) for atopic dermatitis, respectively (Table 2). There was a significant reduction for most individual symptom scores in the SLIT group when compared with controls, including shortness of breath ($p = 0.02$) and wheezing ($p = 0.02$) among asthma patients; (Figure 2) eye discharge ($p = 0.008$), eye redness ($p = 0.0006$), eye

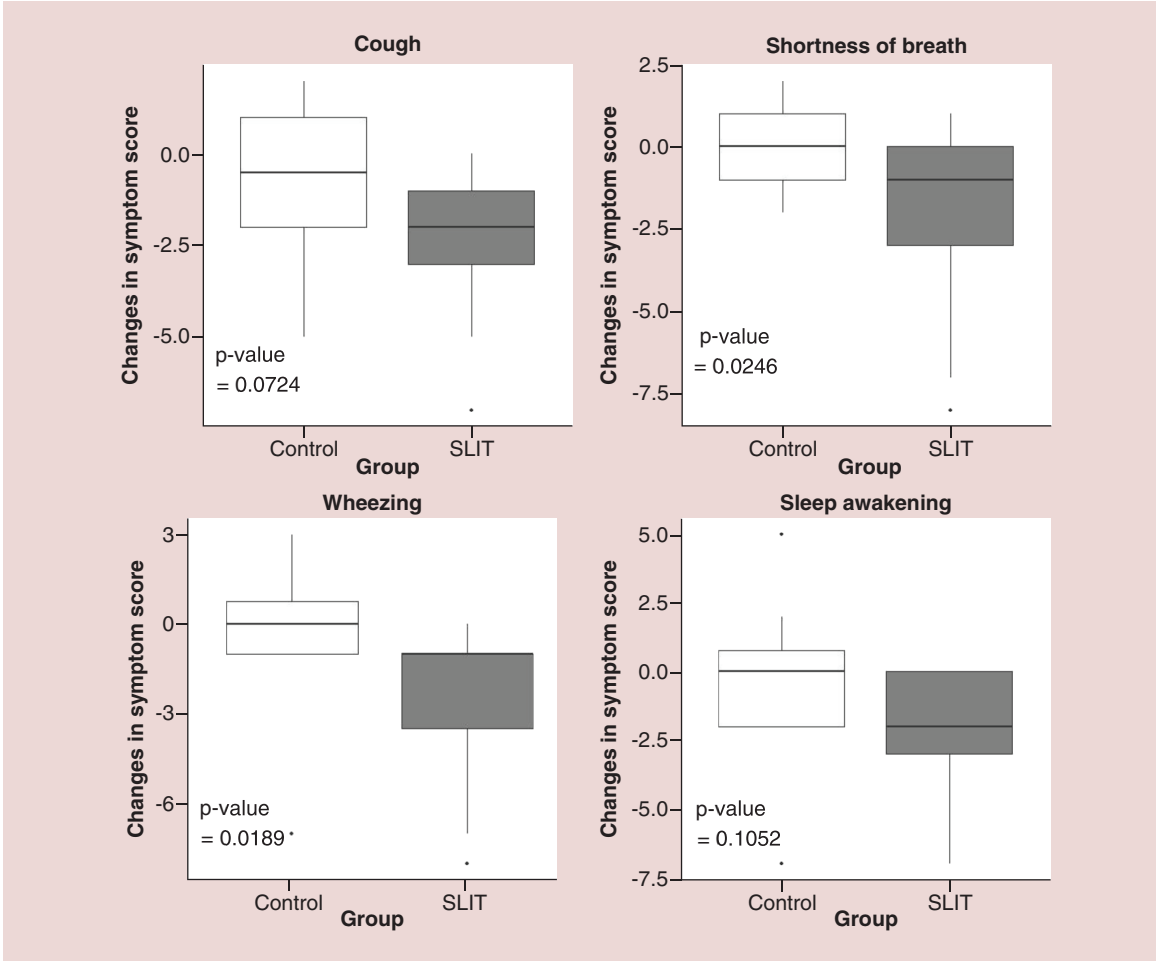

Figure 2. Boxplots of the differences in individual asthma symptom scores.

puffiness (p = 0.005) and eye itchiness (p = 0.0001) among allergic conjunctivitis patients; (Figure 3) and skin oozing (p = 0.008), excoriation (p = 0.04), lichenification (p = 0.04) and pruritus (p = 0.006) among atopic dermatitis patients (Figure 4). The mean duration of the symptomatic period was also significantly reduced for patients with concurrent asthma and allergic conjunctivitis (p = 0.0004 & p = 0.0005, respectively).

The mean (±SD) wheal size of skin prick tests at baseline in the SLIT group were 8.8 mm (±2.4 mm) for Dp and 9.3 mm (±3.5 mm) for Df, which decreased to 7.9 mm (±2.8 mm) and 7.8 mm (±3.6 mm), respectively after the 12 months of treatment. So there were 10.2 and 16.1% reductions in the average wheal size of skin prick tests for Dp & Df. (p = 0.09 & p = 0.025).

The most common treatment-related adverse reactions were mild local sublingual or throat itchiness in the SLIT group, which usually presented in the first few weeks of SLIT commencement. All of the symptoms were self-limiting with or without the use of antihistamines. And none of our patients required to terminate their treatment early.

Discussion

There is relatively little data evaluating the effectiveness of SLIT in improving comorbidities. Our study has shown that SLIT not only significantly reduced clinical symptoms of HDM-induced perennial allergic rhinitis, but also improved its comorbid allergic conditions including concomitant asthma, allergic conjunctivitis and atopic dermatitis for both adult and pediatric patients.

The effect of SLIT on HDM-induced perennial allergic rhinitis was very striking, as reflected by the significant reduction in the total rhinitis as well as individual symptom scores (Table 2; Figures 1–4), as already reported [28]. The benefits of SLIT were further supported by a significant reduction in medication usage (the decrease in nasal

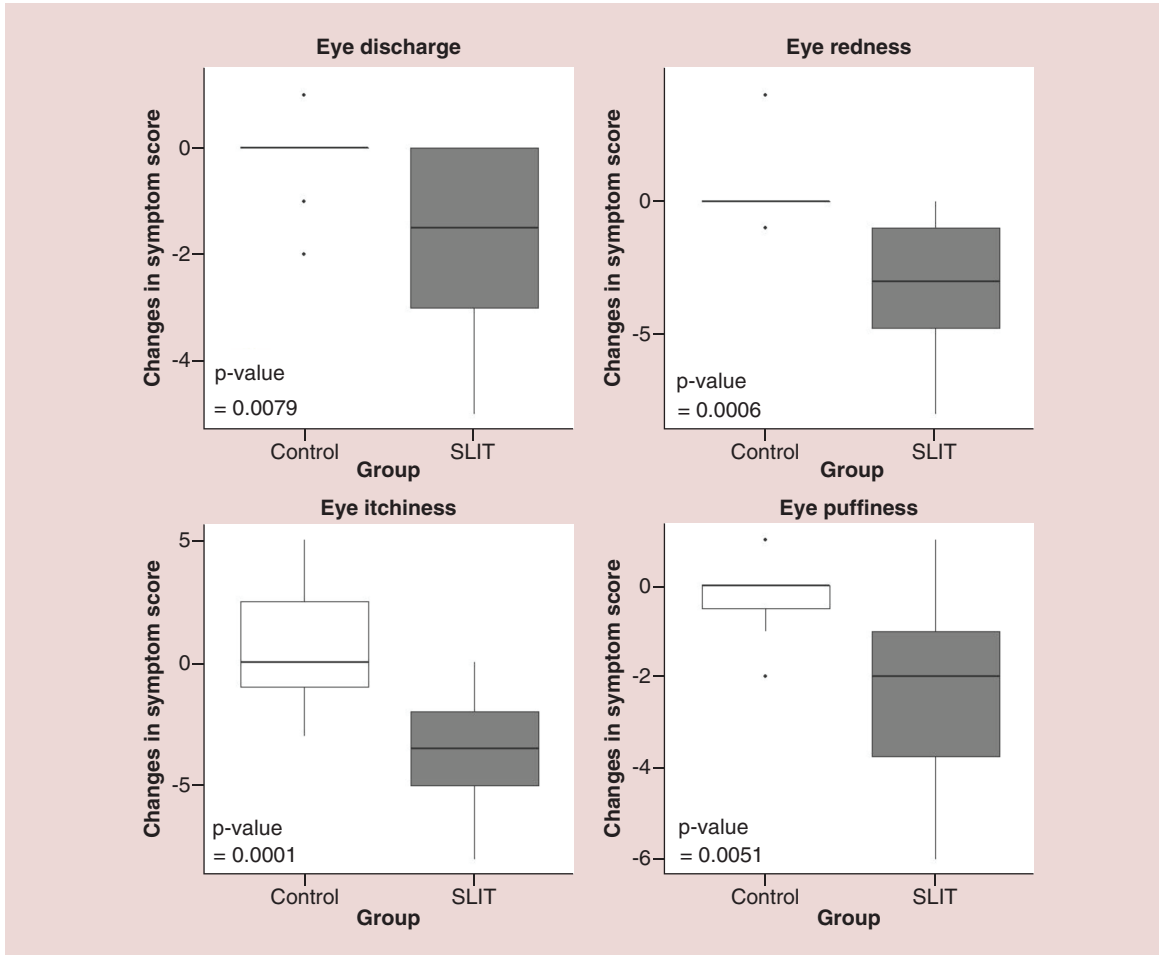

Figure 3. Boxplots of the differences in individual conjunctivitis symptom scores.

steroid and antihistamine usage). The significant decrease in the duration of the symptomatic period and the improvement on activities of daily living suggested that there was a better quality of life for the group of patients who underwent SLIT. It was notable that the use of nasal topical steroids in the control group nearly doubled. This suggests that without SLIT, nasal topical steroids were the mainstay of treatment for these patients. There were reductions in the average wheal size of skin prick test in the SLIT group during the study period, reflecting the effectiveness of SLIT in modulating the immune response.

Most presenting symptoms showed a significant reduction by 12 months in the SLIT group. The power of each subgroup of concurrent allergic diseases might not be large enough to delineate the improvement of each individual symptom. Nonetheless, the total symptom scores for asthma, allergic conjunctivitis and atopic dermatitis remained statistically significant, as well as the reduction of symptomatic period for all patients suffering from comorbid asthma and allergic conjunctivitis.

There was only a small reduction of the total rhinitis symptom scores (-7.3%) in the control group. This was probably due to the poor compliance with the use of nasal topical steroids. Steroid phobia is prevalent and commonly encountered in our locality and surrounding Asian countries, as already reported in some recent Chinese and Korean literature [29,30]. Patients in our study in both the SLIT and control groups were also reluctant to use nasal topical steroid despite repeated counseling. Both groups of patients received the same standard of care by the same team of doctors and nurses. However, most patients were only using their nasal topical steroids intermittently during symptomatic exacerbations, and this may have been the reason for the poor control in the control group without SLIT.

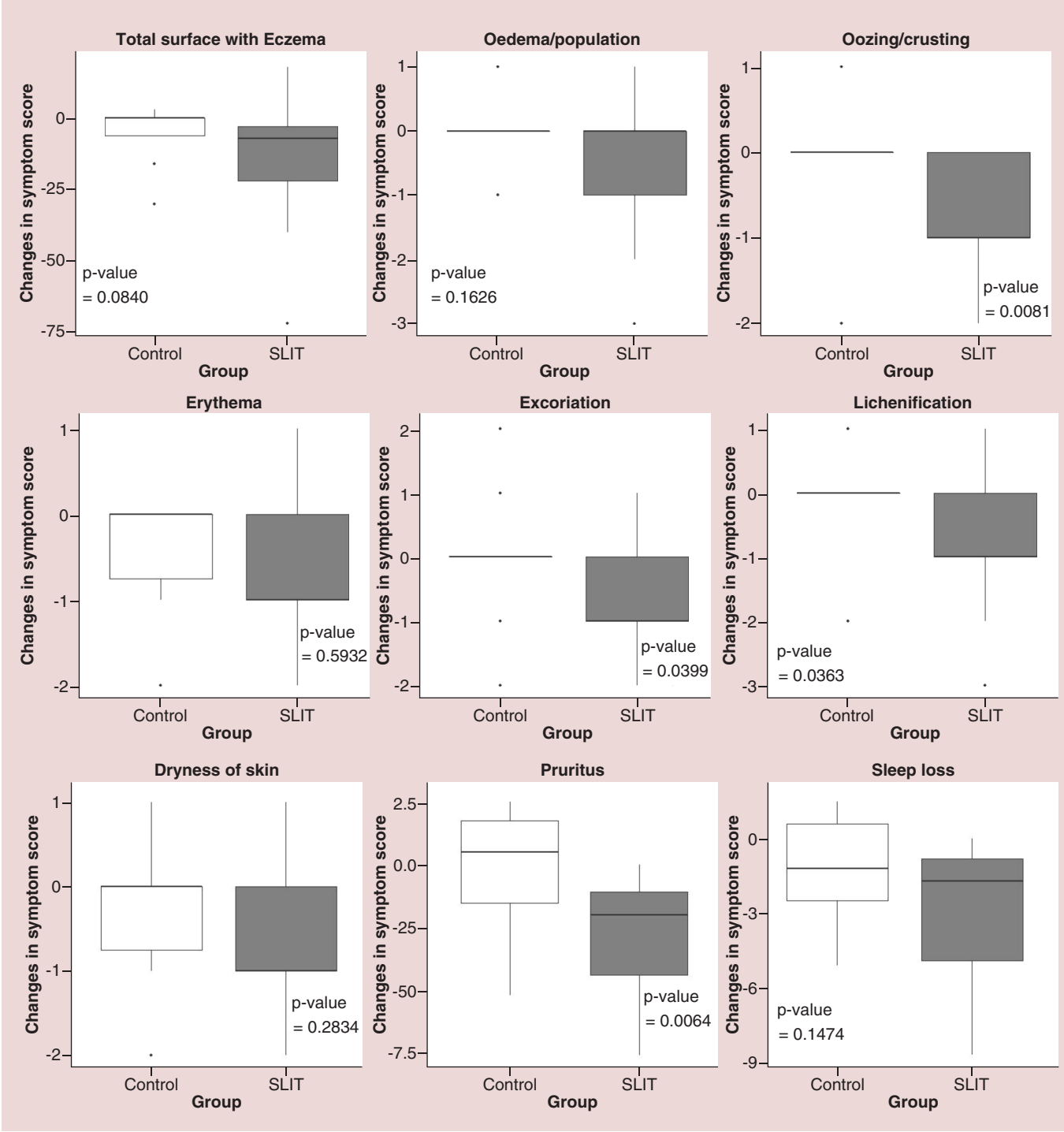

Figure 4. Boxplots of the differences in individual atopic dermatitis symptom scores.

The symptom scores of allergic conjunctivitis, including eye redness, itchiness and the duration of symptomatic period were increased by the end of the study period in the control group. This suggests that without proper treatment of the underlying allergenic cause, the symptoms of allergic conjunctivitis tend to worsen over time.

Double-blinded randomized controlled trials (RCT) have been considered as the reference standard for evaluation of the therapeutic efficacy of a specific treatment. However, RCT are designed to evaluate the efficacy, not the effectiveness of a treatment strategy. The findings from RCT of a well-defined ideal study population may be less

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generalizable when applied to those unselected patient population of daily real-life clinical practice [31]. This is of particular relevance for allergic diseases where patients commonly present with long term or recurrent comorbidities, rather than one particular allergic disease for each patient as designed in most RCTs. Besides, the effects of AIT accumulate over a long period of time and compliance is a crucial factor. In these circumstances, case–control studies as in this trial design could be more practical in evaluating the effectiveness of a treatment over a protracted time.

It has also been suggested that case–control studies may overestimate the benefits of a treatment [32]. However, when comparing meta-analyses of RCTs and observational studies on the same topics, other authors have not agreed [33]. The most important aspect in the methodology of case–control study is to enroll actively treated and control subjects who have a high comparability regarding all confounding factors to reduce potential selection bias. Unmeasured covariates may have unknown effects on the responses in case–control studies. If the baseline characteristics of patients in the treatment and control groups are properly balanced, the results of the case–control study are more convincing.

In the present study, the demographic characteristics for patients in the SLIT group and the control group were similar without any statistical significant difference. While there were more patients with concomitant food allergy in the control group, it did not reach statistical significance and food allergy was not an outcome measure in our study, so it should not have any direct confounding effect on our results.

Our study was open labeled, and this could have been another potential source of bias. While we cannot exclude this possibility altogether, we believe bias was unlikely as all patients were given a set of standardized questions about symptoms to be completed before the follow-up consultation with the physician, so the evaluation of symptom scores were carried out in a 'single-blind' manner.

It would be ideal if all patients could perform skin prick tests, serum-specific IgE and even nasal provocation test to document HDM sensitization. Most our patients had both serum-specific IgE and skin prick test performed, but a minority of pediatric patients were reluctant to undergo venepuncture. In our clinical practice, we proceed to skin prick test and/or serum-specific IgE testing for HDM sensitization only if it is clinically indicated. It has been reported that skin prick test is more sensitive than serum-specific IgE with the added benefit of lower cost [34,35]. However, conclusive evidence that one type of testing is superior to another is still lacking [36]. Our use of HDM skin prick test or serum HDM-specific IgE for diagnosis reflect our real life clinical practice.

There is a diverse variation of allergen sensitization in different regions around the world. But HDM sensitization is still the commonest aeroallergen in our locality of southeast China over the last few decades [37,38].

While SLIT may be more expensive than conventional antihistamines and nasal topical steroids when we only compared their daily unit cost, extensive studies have confirmed its cost–effectiveness [39–43]. The cost of SLIT have to be weighed against the costs of the long term use of pharmacotherapy, the hospital costs and the time lost from work or school in patients who are not treated by AIT and not adequately controlled. Besides, the unique disease modifying effect of AIT can result in long-term remission lasting for many years even after stopping treatment, prevent asthma development and new allergen sensitization in allergic rhinitis patients, and is effective for comorbid allergic conditions as shown in our study. Recent health economic analysis on AIT has suggested that both SLIT and subcutaneous immunotherapy would be considered cost-effective for patients with allergic rhinitis with or without asthma using the criteria of National Institute of Health and Clinical Excellence cost–effectiveness threshold per quality-adjusted life year [44].

The results in this study strengthen our understanding of the effectiveness of SLIT for HDM-induced allergic rhinitis and its concurrent comorbid allergic conditions including asthma, allergic conjunctivitis and atopic dermatitis. We find that the use of SLIT was an adjunctive therapy to conventional pharmacological management that improved not only the outcomes for allergic rhinitis, but also its comorbid allergic conditions.

Author contributions

First author drafted the initial manuscript. Other authors were responsible for planning, reviewing and editing for the manuscript. We have participated sufficiently in the work to take responsibility for the content; we have made substantial contributions to the conception and design, and the analysis and interpretation of the data (where applicable); we have made substantial contributions to the writing or revision of the manuscript.

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Ethical conduct of research

The authors state that they have obtained appropriate institutional review board approval or have followed the principles outlined in the Declaration of Helsinki for all human or animal experimental investigations. In addition, for investigations involving human subjects, informed consent has been obtained from the participants involved.

Data sharing statement

The authors certify that this manuscript reports original clinical trial data. Data reported in this manuscript are available within the article or posted publicly at isrctn.com, according to the required timelines. Additional data from the study (e.g., study protocol) are available upon reasonable request.

Summary points

Background

- Allergen-specific sublingual immunotherapy (SLIT) is a disease modifying treatment for house dust mite (HDM)-induced allergic rhinitis.
- However, research on its effectiveness for comorbid allergic conditions is scarce.

Aim

- The effectiveness of SLIT in patients with HDM-induced allergic rhinitis, and its concomitant comorbid allergic diseases including asthma, allergic conjunctivitis and atopic dermatitis were evaluated in a prospective case-controlled study.

Methods

- A total of 120 adult and pediatric patients with HDM-induced perennial allergic rhinitis were evaluated.
- Cases ($n = 80$) were patients who received SLIT with HDM allergen extract (SLITone Ultra ALK-Abellò).
- Controls ($n = 40$) were age- and sex-matched patients with the same diagnosis who were never treated with SLIT.
- The outcomes were the change in symptom and medication scores of allergic rhinitis, and symptom scores of concurrent asthma, allergic conjunctivitis and atopic dermatitis before and at the end of the 12-month period.

Results

- There was a 53.6% reduction in the total symptom score for allergic rhinitis in the SLIT group after 12 months ($p < 0.0001$), but no statistically significant difference was shown in controls (-7.3%, $p = 0.99$).
- For individual rhinitis symptoms including rhinorrhea, sneezing, nasal congestion and itchiness, there were more than 50% reduction of symptom scores in the SLIT group ($p < 0.0001$).
- At enrollment, 83.8% of patients in the SLIT group were using nasal topical steroids regularly but only 21.3% were still using it by the end of the study period, so three quarters of them had been weaned off nasal topical steroids successfully. In contrast, the use of nasal topical steroids in control subjects increased by 40%.
- Almost all patients required the use of antihistamines for symptom control at the start, but half of those in the SLIT group were able to wean them off by the end of the study period, whereas 98% of patients in the control group still required the treatment regularly.
- In the SLIT group, the total symptom scores for concurrent asthma decreased from 17.79 to 8.8 ($p < 0.0001$); for allergic conjunctivitis from 20.89 to 10.0 ($p = 0.0002$); and for atopic dermatitis the SCORAD from 46.40 to 29.38 ($p = 0.0004$).
- For the control group, the total symptom score for asthma changed from 19.70 to 18.30 ($p = 0.99$), for allergic conjunctivitis from 8.09 to 9.09 ($p = 0.92$) and for atopic dermatitis from 33.20 to 24.97 ($p = 0.62$).
- The mean wheal size of skin prick test in the SLIT group decreased 10.2 and 16.1%, respectively for Dermatophagoides pteronyssinus ($p = 0.0894$) and Dermatophagoides farina ($p = 0.0256$).
- The most common treatment-related adverse reactions were mild local sublingual or throat itchiness for the first few weeks after SLIT commencement, but the symptoms were self-limiting.

Conclusion

- During the 12-month study period, patients treated with SLIT showed a significant reduction in symptom scores for HDM-induced allergic rhinitis, as well as concurrent allergic conditions including asthma, allergic conjunctivitis and atopic dermatitis.
- Though SLIT may be more expensive than antihistamines and nasal topical steroids, it was an adjunctive therapy to conventional pharmacological management that improved not only the treatment outcomes for allergic rhinitis, but also its comorbid allergic conditions.

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