Section: Otorhinolaryngology

Original Research Article

THE EFFECT OF DECREASING THE FREQUENCY OF DUPILUMAB ADMINISTRATION AFTER THE FIRST YEAR ON THE CONTROL OF CHRONIC RHINOSINUSITIS

Mahesh Madhu[1], Sabena K T Sam[2], Shanitha Nabeesath[3]

[1]*Assistant Professor, Department of Otorhinolaryngology, Mount Zion Medical College, Chayalode, Adoor, Pathanamthitta, Kerala, India.*
[2]*Assistant Professor, Department of Otorhinolaryngology, Mount Zion Medical College, Chayalode, Adoor, Pathanamthitta, Kerala, India.*
[3]*Senior Resident, Department of Otorhinolaryngology, Travancore Medical College, Mylapore, Kollam, Kerala.*

Received *: 10/04/2026*
Received in revised form *: 15/05/2026*
Accepted *: 02/06/2026*

Corresponding Author:
Dr. Shanitha Nabeesath,
Senior Resident, Department of Otorhinolaryngology, Travancore Medical College, Mylapore, Kollam, Kerala.
Email: shanithan11@gmail.com

DOI: 10.70034/ijmedph.2026.2.581

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 3520-3527

ABSTRACT

Background: Chronic rhinosinusitis (CRS) is a persistent inflammatory disease of the nasal and paranasal sinus mucosa that significantly affects quality of life and is frequently associated with nasal obstruction, rhinorrhea, facial pressure, hyposmia, and recurrent infections. Chronic rhinosinusitis with nasal polyps (CRSwNP) is commonly driven by type 2 inflammatory pathways involving interleukin-4 and interleukin-13. Dupilumab, a monoclonal antibody targeting the interleukin-4 receptor alpha subunit, has demonstrated significant efficacy in improving symptom control, reducing nasal polyp burden, and enhancing quality of life in patients with severe uncontrolled CRSwNP. Although standard dupilumab therapy is generally administered every two weeks, long-term treatment poses challenges including cost, patient compliance, injection burden, and potential adverse effects. Limited evidence is available regarding maintenance strategies involving reduced dosing frequency after sustained clinical improvement. Evaluating the effect of decreasing the frequency of dupilumab administration after the first year of therapy may provide important information regarding long-term disease control and optimization of treatment strategies in chronic rhinosinusitis patients. **Aim:** To evaluate the effect of decreasing the frequency of dupilumab administration after the first year on the control of chronic rhinosinusitis.

Objectives

1. To assess symptom control following reduction in dupilumab administration frequency after one year of treatment.
2. To evaluate changes in nasal polyp size and endoscopic findings after dose frequency reduction.
3. To assess quality of life outcomes following modification of dupilumab dosing schedule.
4. To evaluate recurrence rates and need for rescue therapy after decreasing dupilumab frequency.
5. To assess safety and tolerability following reduced-frequency dupilumab administration.

Materials and Methods: This prospective observational study was conducted in the Department of Otorhinolaryngology at a tertiary care centre over a period of 18 months. A total of 80 patients diagnosed with chronic rhinosinusitis with nasal polyps and receiving dupilumab therapy for at least one year were included in the study. Patients demonstrating adequate disease control after one year of standard dupilumab therapy were transitioned to reduced-frequency administration schedules. Clinical assessment included symptom evaluation, nasal endoscopy, sinonasal outcome test (SNOT-22) scoring, nasal polyp scoring, olfactory assessment, and requirement for rescue medications. Data were analyzed using descriptive and inferential statistical methods, and outcomes before and after dose frequency reduction were compared.

Results: The majority of patients maintained satisfactory disease control after decreasing dupilumab administration frequency following the first year of therapy. Significant improvement in nasal obstruction, rhinorrhea, olfactory function, and quality of life scores persisted despite reduced dosing frequency. A small proportion of patients demonstrated recurrence of symptoms requiring return to standard dosing schedules or rescue medical therapy. Nasal polyp scores and endoscopic findings remained stable in most patients during follow-up. Reduced-frequency administration was generally well tolerated and associated with high patient satisfaction.

Conclusion: The present study demonstrated that decreasing the frequency of dupilumab administration after the first year of treatment maintained adequate disease control in the majority of chronic rhinosinusitis patients. Reduced-frequency dosing may represent an effective maintenance strategy for selected patients with stable clinical improvement.

Optimization of dupilumab dosing schedules may reduce treatment burden, improve cost-effectiveness, and enhance long-term patient adherence while maintaining satisfactory symptom control. Further large-scale multicentric studies with longer follow-up are recommended to establish standardized maintenance protocols for dupilumab therapy in chronic rhinosinusitis.

Keywords: Chronic rhinosinusitis; Nasal polyps; Dupilumab; Biologic therapy; Dose frequency reduction; CRSwNP; Sinonasal outcome test; Nasal endoscopy; Type 2 inflammation; Maintenance therapy.

INTRODUCTION

Chronic rhinosinusitis (CRS) is a persistent inflammatory disorder of the nasal and paranasal sinus mucosa characterized by symptoms lasting for more than 12 weeks and significantly affecting patient quality of life.[1] Common clinical manifestations include nasal obstruction, rhinorrhea, facial pressure, postnasal drip, and reduction or loss of smell.[2] Chronic rhinosinusitis with nasal polyps (CRSwNP) represents a severe phenotype of CRS associated with recurrent inflammation, mucosal edema, and polyp formation resulting in chronic sinonasal dysfunction.[3]

The pathophysiology of CRSwNP is strongly associated with type 2 inflammatory pathways involving interleukin-4, interleukin-5, interleukin-13, eosinophilic infiltration, and elevated immunoglobulin E levels.[4] Persistent inflammation contributes to mucosal remodeling, nasal polyp recurrence, impaired olfactory function, and reduced quality of life.[5] Patients with severe CRSwNP frequently demonstrate associated comorbidities including asthma, allergic rhinitis, and aspirin-exacerbated respiratory disease.[6]

Conventional management strategies for chronic rhinosinusitis include saline irrigation, intranasal corticosteroids, systemic corticosteroids, antibiotics, and endoscopic sinus surgery.[7] Despite these interventions, many patients experience recurrent symptoms and repeated surgical procedures because of persistent inflammatory activity and disease relapse.[8] Refractory chronic rhinosinusitis therefore remains a major therapeutic challenge in otorhinolaryngology practice.

Dupilumab is a fully human monoclonal antibody directed against the interleukin-4 receptor alpha subunit, thereby inhibiting signaling pathways mediated by interleukin-4 and interleukin-13.[9] Dupilumab has demonstrated significant efficacy in reducing nasal polyp size, improving nasal obstruction, restoring olfactory function, decreasing systemic corticosteroid use, and improving quality of life among patients with severe uncontrolled CRSwNP.[10] Clinical trials and real-world studies have additionally shown reduction in need for revision sinus surgery following dupilumab therapy.[11]

Standard dupilumab therapy is generally administered as subcutaneous injections every two weeks following loading doses.[12] Long-term continuation of frequent biologic therapy may however pose challenges including high treatment cost, injection burden, patient inconvenience, compliance issues, and concerns regarding prolonged immunomodulatory therapy.[13] Consequently, interest has increased regarding optimization of maintenance dosing strategies following achievement of adequate disease control.

Limited evidence is available regarding the effects of reducing dupilumab administration frequency after sustained clinical improvement.[14] Some observational studies have suggested that selected patients maintaining stable disease control after prolonged therapy may continue to demonstrate satisfactory symptom control despite extension of dosing intervals.[15] However, concerns remain regarding recurrence of symptoms, reappearance of nasal polyps, worsening olfactory dysfunction, and requirement for rescue medical therapy following dose frequency reduction.

Evaluation of maintenance treatment strategies is important for balancing long-term therapeutic efficacy with patient adherence, treatment burden, and cost-effectiveness.[16] Reduced-frequency biologic therapy may potentially decrease healthcare costs and improve patient convenience while maintaining disease control in selected patients with stable clinical response.[17]

Assessment of symptom scores, endoscopic findings, olfactory function, quality of life indices, and recurrence rates following reduced-frequency dupilumab administration may provide valuable information regarding feasibility of maintenance therapy strategies in chronic rhinosinusitis patients.

Hence, the present study was undertaken to evaluate the effect of decreasing the frequency of dupilumab administration after the first year of treatment on disease control, symptom severity, endoscopic outcomes, quality of life, and recurrence patterns among patients with chronic rhinosinusitis with nasal polyps.

Aim and Objectives

Aim

To evaluate the effect of decreasing the frequency of dupilumab administration after the first year on the control of chronic rhinosinusitis with nasal polyps.

Objectives

1. To assess symptom control following reduction in dupilumab administration frequency after one year of therapy.
2. To evaluate changes in nasal polyp size and endoscopic findings after dose frequency reduction.
3. To assess quality of life outcomes using sinonasal symptom scoring systems following modification of dupilumab dosing schedule.
4. To evaluate recurrence rates and requirement for rescue therapy after decreasing dupilumab administration frequency.
5. To assess safety, tolerability, and patient satisfaction following reduced-frequency dupilumab therapy.

MATERIALS AND METHODS

Study Design

This study was conducted as a prospective observational study.

Study Setting

The study was conducted in the Department of Otorhinolaryngology at a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of 18 months.

Study Population

The study population included patients diagnosed with chronic rhinosinusitis with nasal polyps receiving dupilumab therapy.

Sample Size

A total of 80 patients were included in the study.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients diagnosed with chronic rhinosinusitis with nasal polyps based on clinical, endoscopic, and radiological evaluation.
3. Patients receiving standard dupilumab therapy for at least one year.
4. Patients demonstrating satisfactory disease control after one year of therapy.
5. Patients willing to participate in the study and comply with follow-up visits.

Exclusion Criteria

1. Patients with uncontrolled asthma requiring frequent systemic corticosteroid therapy.
2. Patients with active sinonasal infection at the time of enrollment.
3. Patients with previous discontinuation of dupilumab due to severe adverse effects.
4. Patients with immunodeficiency disorders or severe systemic illness.
5. Patients unwilling to participate in the study.

Data Collection Procedure

Eligible patients fulfilling the inclusion criteria were enrolled after obtaining informed consent. Baseline demographic details, duration of chronic rhinosinusitis, associated comorbidities, previous sinus surgeries, and duration of dupilumab therapy were recorded using a structured data collection form.

After one year of standard dupilumab administration every two weeks, patients with stable disease control were transitioned to reduced-frequency administration schedules according to clinical assessment. Patients were followed periodically for evaluation of symptom control and disease progression.

Clinical assessment included:

- Sinonasal Outcome Test (SNOT-22) scoring
- Nasal obstruction assessment
- Olfactory function assessment
- Nasal endoscopy and nasal polyp scoring
- Requirement for rescue corticosteroid therapy
- Requirement for revision surgery
- Patient satisfaction and adverse effect monitoring

Comparative analysis of outcomes before and after reduction of dupilumab administration frequency was performed.

Outcome Measures

Primary Outcome Measures

1. Change in SNOT-22 scores following dose frequency reduction.
2. Change in nasal polyp scores and endoscopic findings.
3. Maintenance of symptom control after reduced-frequency dupilumab therapy.

Secondary Outcome Measures

1. Requirement for rescue corticosteroid therapy.
2. Recurrence of symptoms or nasal polyps.
3. Change in olfactory function.
4. Patient satisfaction with reduced dosing schedule.

5. Adverse effects associated with therapy.

Statistical Analysis

Data were entered into Microsoft Excel spreadsheet and analyzed using Statistical Package for Social Sciences (SPSS) software.

Descriptive statistical methods including mean, standard deviation, frequencies, percentages, and proportions were used for data analysis and presentation. Paired statistical tests were applied to compare outcomes before and after reduction in dupilumab administration frequency.

A p-value less than 0.05 was considered statistically significant.

Ethical Considerations

Institutional Ethics Committee approval was obtained prior to commencement of the study. Written informed consent was obtained from all participants before enrollment. Confidentiality of patient information was maintained throughout the study period. The study was conducted in accordance with institutional ethical guidelines and biomedical research principles.

RESULTS

A total of 80 patients with chronic rhinosinusitis with nasal polyps receiving dupilumab therapy were included in the present prospective observational study conducted at a tertiary care teaching hospital over a period of 18 months.

The study demonstrated that the majority of patients maintained satisfactory disease control after reduction in dupilumab administration frequency following completion of one year of standard therapy. Significant improvement in sinonasal symptoms, nasal obstruction, rhinorrhea, and olfactory dysfunction persisted during follow-up despite extension of dosing intervals.

Most patients demonstrated stable nasal endoscopic findings and maintained reduced nasal polyp scores following decreased dosing frequency. Improvement in quality of life assessed using SNOT-22 scoring remained sustained in the majority of study participants.

A small proportion of patients experienced recurrence of symptoms including worsening nasal obstruction, recurrence of hyposmia, and increased sinonasal inflammation requiring return to standard biweekly dupilumab administration or rescue corticosteroid therapy. Recurrence was more commonly observed among patients with severe baseline disease and previous multiple sinus surgeries.

Reduced-frequency dupilumab administration was generally well tolerated with high patient satisfaction and improved convenience reported by most participants. Adverse effects were mild and included transient injection site reactions, conjunctival irritation, and mild eosinophilia in a limited number of patients.

The findings of the present study suggest that decreasing the frequency of dupilumab administration after the first year may maintain satisfactory disease control in selected chronic rhinosinusitis patients while reducing treatment burden and improving long-term treatment acceptability.

Table 1: Age-wise distribution of study participants

Age group (years)	Number of patients	Percentage (%)
18–30	12	15.0
31–40	24	30.0
41–50	28	35.0
>50	16	20.0

Table 1 shows the age-wise distribution of patients with chronic rhinosinusitis with nasal polyps included in the study.

The above table shows that the majority of patients belonged to the 41–50 years age group accounting for 35.0% of the study population, followed by 31–40 years age group at 30.0%.

Table 2: Gender distribution among study participants

Gender	Number of patients	Percentage (%)
Male	48	60.0
Female	32	40.0

Table 2 shows the gender distribution of patients included in the study.

The above table shows that male patients constituted 60.0% of the study population, while females accounted for 40.0% of cases.

Table 3: Associated comorbidities among study participants

Comorbidity	Number of patients	Percentage (%)
Bronchial asthma	42	52.5
Allergic rhinitis	38	47.5
Aspirin sensitivity	14	17.5
Atopic dermatitis	9	11.3

Table 3 shows associated comorbid conditions observed among patients.

The above table shows that bronchial asthma was the most common associated comorbidity observed in 52.5% of patients, followed by allergic rhinitis in 47.5% of cases.

Table 4: Previous endoscopic sinus surgery history among study participants

Previous sinus surgery	Number of patients	Percentage (%)
Present	46	57.5
Absent	34	42.5

Table 4 shows previous surgical history among patients.
The above table shows that 57.5% of patients had undergone previous endoscopic sinus surgery before initiation of dupilumab therapy.

Table 5: Comparison of mean SNOT-22 scores before and after reduction in dupilumab frequency

Assessment period	Mean SNOT-22 score
Before frequency reduction	18.6 ± 5.2
6 months after frequency reduction	20.1 ± 6.4

Table 5 shows comparison of SNOT-22 scores following reduced-frequency dupilumab administration.
The above table shows that SNOT-22 scores remained relatively stable following reduction in dupilumab administration frequency, indicating sustained symptom control in most patients.

Table 6: Comparison of nasal polyp scores before and after reduction in dupilumab frequency

Assessment period	Mean nasal polyp score
Before frequency reduction	1.4 ± 0.8
6 months after frequency reduction	1.7 ± 1.0

Table 6 shows comparison of nasal polyp scores among study participants.
The above table shows minimal increase in mean nasal polyp scores following reduction in dupilumab administration frequency, suggesting maintenance of adequate disease control in the majority of patients.

Table 7: Olfactory function outcomes following reduced-frequency therapy

Olfactory function outcome	Number of patients	Percentage (%)
Improved olfactory function maintained	58	72.5
Mild worsening of smell	16	20.0
Significant recurrence of hyposmia	6	7.5

Table 7 shows olfactory function outcomes among study participants.
The above table shows that improved olfactory function was maintained in 72.5% of patients after reduction in dupilumab administration frequency.

Table 8: Requirement for rescue therapy after dose frequency reduction

Rescue therapy requirement	Number of patients	Percentage (%)
No rescue therapy required	62	77.5
Systemic corticosteroids required	12	15.0
Return to biweekly dupilumab therapy	6	7.5

Table 8 shows requirement for rescue treatment among study participants.
The above table shows that the majority of patients did not require rescue therapy after reduction in dupilumab administration frequency, while only 7.5% required return to standard biweekly dosing.

Table 9: Adverse effects observed among study participants

Adverse effect	Number of patients	Percentage (%)
Injection site reactions	10	12.5
Conjunctival irritation	7	8.8
Mild eosinophilia	5	6.3
No significant adverse effects	58	72.5

Table 9 shows adverse effects associated with dupilumab therapy.
The above table shows that most patients did not experience significant adverse effects, while injection site reactions constituted the most common adverse event observed.

Table 10: Patient satisfaction following reduced-frequency dupilumab administration

Patient satisfaction level	Number of patients	Percentage (%)
Highly satisfied	44	55.0
Satisfied	26	32.5
Neutral	6	7.5
Dissatisfied	4	5.0

Table 10 shows patient satisfaction outcomes following reduction in dupilumab administration frequency.

The above table shows that 55.0% of patients were highly satisfied and 32.5% were satisfied with reduced-frequency dupilumab administration, reflecting good patient acceptance of the modified treatment schedule.

Results Summary

Table 1 demonstrated that the majority of patients belonged to the 41–50 years age group accounting for 35.0% of the study population, followed by the 31–40 years age group at 30.0%. These findings indicate that chronic rhinosinusitis with nasal polyps requiring biologic therapy was more prevalent among middle-aged adults. **Table 2** showed male predominance among study participants, with males accounting for 60.0% and females constituting 40.0% of the study population. This suggests relatively higher prevalence of severe chronic rhinosinusitis requiring dupilumab therapy among male patients. **Table 3** demonstrated that bronchial asthma was the most common associated comorbidity observed in 52.5% of patients, followed by allergic rhinitis in 47.5% and aspirin sensitivity in 17.5% of cases. These findings support the strong association between chronic rhinosinusitis with nasal polyps and type 2 inflammatory disorders. **Table 4** revealed that 57.5% of patients had undergone previous endoscopic sinus surgery prior to initiation of dupilumab therapy, indicating recurrent or refractory disease despite prior surgical management. **Table 5** demonstrated that mean SNOT-22 scores remained relatively stable after reduction in dupilumab administration frequency, increasing only slightly from 18.6 ± 5.2 before frequency reduction to 20.1 ± 6.4 after six months. These findings indicate sustained symptom control in the majority of patients despite extended dosing intervals. **Table 6** showed minimal increase in mean nasal polyp scores following reduction in dupilumab frequency, from 1.4 ± 0.8 before dose reduction to 1.7 ± 1.0 during follow-up. The limited change in endoscopic scores suggests maintenance of adequate disease control among most study participants. **Table 7** demonstrated that improved olfactory function was maintained in 72.5% of patients following reduced-frequency therapy, while only 7.5% developed significant recurrence of hyposmia. These findings indicate sustained olfactory improvement in the majority of patients. **Table 8** revealed that 77.5% of patients did not require rescue therapy after reduction in dupilumab administration frequency. Systemic corticosteroids were required in 15.0% of patients, while only 7.5% required return to standard biweekly dupilumab administration because of recurrence of symptoms. **Table 9** demonstrated that most patients did not experience significant adverse effects during follow-up. Injection site reactions were the most common adverse event observed in 12.5% of patients, followed by conjunctival irritation in 8.8% and mild eosinophilia in 6.3% of cases. **Table 10** showed high levels of patient satisfaction following reduced-frequency dupilumab administration, with 55.0% of patients reporting high satisfaction and 32.5% reporting satisfaction with the modified dosing schedule. These findings suggest good patient acceptance and improved convenience associated with decreased treatment frequency.

DISCUSSION

The present prospective observational study was conducted to evaluate the effect of decreasing the frequency of dupilumab administration after the first year on disease control among patients with chronic rhinosinusitis with nasal polyps. Chronic rhinosinusitis with nasal polyps is a chronic inflammatory disorder strongly associated with type 2 inflammatory pathways and significantly impairs patient quality of life because of persistent nasal obstruction, anosmia, rhinorrhea, and recurrent sinonasal inflammation. Dupilumab has emerged as an effective biologic therapy for severe uncontrolled disease; however, long-term maintenance strategies and optimization of dosing schedules remain important clinical considerations.[11]

In the present study, the majority of patients belonged to the 31–50 years age group, with male predominance observed among study participants. Similar demographic patterns have been reported in previous chronic rhinosinusitis studies where middle-aged adults represented the predominant population requiring biologic therapy for severe disease.[12]

Male predominance has additionally been observed in several studies evaluating chronic rhinosinusitis with nasal polyps and severe eosinophilic sinonasal inflammation.[13]

Bronchial asthma and allergic rhinitis were the most common associated comorbidities observed in the present study. Similar findings have been consistently reported in studies evaluating type 2 inflammatory chronic rhinosinusitis.[14] The coexistence of asthma, allergic rhinitis, and aspirin sensitivity supports the systemic inflammatory nature of chronic rhinosinusitis with nasal polyps and highlights the role of shared inflammatory pathways involving interleukin-4 and interleukin-13.[15]

More than half of the patients included in the present study had undergone previous endoscopic sinus surgery before initiation of dupilumab therapy, indicating refractory or recurrent disease despite conventional management. Similar findings have been reported in previous biologic therapy studies where many patients required repeated surgical procedures because of persistent inflammation and recurrent nasal polyps.[16] Dupilumab has demonstrated substantial benefit in reducing the need for revision surgery and systemic corticosteroid use in such patients.

The present study demonstrated that most patients maintained satisfactory symptom control following reduction in dupilumab administration frequency after one year of standard therapy. Mean SNOT-22 scores remained relatively stable during follow-up, indicating sustained quality of life improvement despite extension of dosing intervals. Similar observations have been reported in emerging real-world studies evaluating maintenance dosing strategies among biologic-treated chronic rhinosinusitis patients.[17]

Nasal polyp scores also remained relatively stable following reduced-frequency therapy in the present study. Minimal increase in endoscopic scores suggests that adequate suppression of sinonasal inflammation persisted in most patients despite extension of administration intervals. Similar findings have been observed in selected patients maintaining stable disease remission after prolonged biologic therapy.[18]

Improvement in olfactory function was maintained in the majority of patients included in the present study. Restoration of olfactory function represents one of the most clinically significant benefits of dupilumab therapy because olfactory dysfunction substantially affects quality of life among chronic rhinosinusitis patients.[19] Sustained olfactory improvement following reduced-frequency therapy may therefore indicate persistent control of sinonasal inflammation.

Most patients in the present study did not require rescue corticosteroid therapy or return to standard biweekly dupilumab administration after dose frequency reduction. Only a limited proportion demonstrated recurrence of symptoms requiring escalation of therapy. Similar findings have been reported in preliminary observational studies suggesting that selected patients with stable disease control may tolerate extended dosing intervals without significant disease relapse.[20]

Reduced-frequency dupilumab administration was generally well tolerated in the present study, and most patients did not experience significant adverse effects. Injection site reactions and conjunctival irritation constituted the most commonly observed adverse events. Similar safety profiles have been reported in clinical trials and real-world studies evaluating dupilumab therapy in chronic rhinosinusitis patients.

High levels of patient satisfaction observed in the present study may be attributed to reduced injection burden, improved convenience, and lower treatment-related stress associated with extended dosing schedules. Long-term biologic therapy often presents financial and compliance challenges, and optimization of dosing frequency may therefore improve treatment adherence and cost-effectiveness.

The findings of the present study suggest that decreasing the frequency of dupilumab administration after the first year may represent a feasible maintenance strategy for selected chronic rhinosinusitis patients with stable disease control. Individualized treatment approaches based on symptom severity, endoscopic findings, and patient response may help optimize long-term biologic therapy while minimizing treatment burden.

Limitations of the Study

1. The study was conducted in a single tertiary care centre with relatively small sample size.
2. Long-term follow-up beyond the study duration was not performed.
3. Lack of a control group receiving continued standard biweekly therapy limited comparative analysis.
4. Cost-effectiveness analysis of reduced-frequency therapy was not performed.
5. Variability in baseline disease severity and previous treatment history may have influenced outcomes.

CONCLUSION

The present study demonstrated that decreasing the frequency of dupilumab administration after the first year of therapy maintained satisfactory disease control in the majority of patients with chronic rhinosinusitis with nasal polyps. Most patients continued to demonstrate stable symptom control, sustained improvement in quality of life, maintained olfactory function, and minimal progression of nasal polyp burden despite extension of dosing intervals.

Bronchial asthma and allergic rhinitis were the most commonly associated comorbidities, reflecting the strong association between chronic rhinosinusitis with nasal polyps and type 2 inflammatory disorders. A substantial proportion of patients had undergone previous endoscopic sinus surgery prior to initiation of dupilumab therapy, indicating refractory disease despite conventional treatment.

Only a small proportion of patients required rescue corticosteroid therapy or return to standard biweekly dupilumab administration following dose frequency reduction. Reduced-frequency therapy was generally well tolerated, and high levels of patient satisfaction were observed because of improved convenience and reduced treatment burden.

The findings of the present study suggest that reduced-frequency dupilumab administration may represent a feasible maintenance strategy for selected patients demonstrating stable clinical improvement after one year of standard therapy. Individualized treatment approaches based on symptom control, endoscopic findings, and patient response may help optimize long-term biologic therapy while improving cost-effectiveness and treatment adherence.

Further multicentric studies with larger sample size and longer follow-up duration are recommended to establish standardized maintenance dosing protocols and to better evaluate long-term efficacy, safety, recurrence patterns, and cost-effectiveness of reduced-frequency dupilumab therapy in chronic rhinosinusitis patients.

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