

Increased Demodex Density and Risk of Demodicosis After Septorhinoplasty: A Prospective Cohort Study

Sevgi Kulaklı¹, Işıl Deniz Oğuz², Yonca Çoluk³

¹ Istanbul Medipol Mega University Hospital, Department of Dermatology and Venereology, Istanbul, Turkey

² Giresun University Faculty of Medicine, Department of Dermatology and Venereology, Giresun, Turkey

³ Giresun University Faculty of Medicine, Department of Otorhinolaryngology, Giresun, Turkey

Key words: Demodex, Demodicosis, Septorhinoplasty, Mite infestation, Prospective cohort study

Citation: Kulaklı S, Oğuz ID, Çoluk Y. Increased Demodex Density and Risk of Demodicosis After Septorhinoplasty: A Prospective Cohort Study. *Dermatol Pract Concept*. 2026;16(1):6113. DOI: <https://doi.org/10.5826/dpc.1601a6113>

Accepted: August 5, 2025; **Published:** January 2026

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Funding: None.

Competing Interests: None.

Authorship: All authors have contributed significantly to this publication.

Corresponding Author: Sevgi Kulaklı, M.D, Istanbul Medipol Mega University Hospital, 34000, İstanbul, Turkey. ORCID number: 0000-0001-7886-1060. E-mail: sevgi.kulakli@medipol.com.tr

ABSTRACT Introduction: Demodex mites reside in the hair follicles and sebaceous glands of the head and face. An increase in their population can lead to primary or secondary demodicosis. Septorhinoplasty is a frequently performed aesthetic surgical procedure that can cause various cutaneous complications in the facial area.

Objectives: This study aimed to investigate the density of Demodex mites and the prevalence of demodicosis following septorhinoplasty.

Methods: A total of 40 patients (29 females, 11 males) scheduled for septorhinoplasty, with a mean age of 26.25±7.47 years, were evaluated for clinical findings of demodicosis before and at the third month after surgery. Demodex density was assessed using the standardized skin surface biopsy technique, a noninvasive method involving cyanoacrylate adhesive, and microscopic evaluation of samples taken from the bilateral cheeks and nose.

Results: A statistically significant increase was observed in the number of Demodex mites in the malar and nasal regions and in the prevalence of demodicosis following septorhinoplasty. Additionally, the frequency of seborrhea and pustules showed a significant rise. Symptoms related to demodicosis were found to appear around the 22nd postoperative day and persisted up to the third month.

Conclusions: Demodicosis should be considered in the differential diagnosis of patients presenting with erythema, papules, and pustules in both the early and late postoperative periods following septorhinoplasty, and necessary diagnostic investigations should be performed. Further large-scale studies with a greater number of patients are required to support our findings.

Introduction

Demodex mites are parasites measuring 0.1-0.4 mm in size that are part of the skin microbiota of many mammals. They have a worm-like body, four pairs of short legs, and a segmented abdomen. *Demodex folliculorum* and *Demodex brevis* are the two species of Demodex that live in hair follicles and sebaceous glands in humans. Demodex mites prefer to inhabit the facial region and can be found in normal skin at a density of up to <5 mites/cm² [1]. Demodicosis is a skin disease associated with Demodex mites that primarily affects the face and head. It can be primary or secondary to local or systemic immunosuppressive conditions [2]. An increased density of Demodex on the skin has been shown in various skin diseases that primarily affect the face, such as rosacea, acne, perioral dermatitis, and seborrheic dermatitis [3]. Factors that may influence the density of Demodex on the skin include the host's age, immune status, and the size and function of the sebaceous glands [4].

Surgical rhinoplasty, one of the most commonly performed aesthetic surgical procedures worldwide, is performed for cosmetic and/or functional purposes to reshape and resize the nose [5]. While the procedure primarily alters the cartilage and bone structure of the nose, the soft tissue envelope and skin covering the nose are also important components for successful surgery [6]. In addition to early postoperative changes, such as facial edema and ecchymosis, various skin lesions, including contact dermatitis, acne, increased oiliness, seborrheic dermatitis, persistent erythema, and telangiectasia on the nose, have been reported. It is believed that factors such as increased sebum secretion due to elevated adrenocorticotropic hormone (ACTH) levels resulting from surgical stress, disruption of skin integrity in open rhinoplasty, the use of adhesive tapes in the early postoperative period, and patients refraining from washing their faces for some time after surgery may trigger cutaneous lesions [5-10].

Objectives

Increased Demodex density may have clinical implications, as it has been associated with inflammatory skin conditions such as rosacea and may be misdiagnosed as acne, potentially leading to inappropriate management. Based on the

hypothesis that surgical rhinoplasty, an intervention performed on the facial region, may affect the density of Demodex mites, which primarily inhabit the face, we evaluated the density of Demodex mites in the facial region and the prevalence of demodicosis before and after septorhinoplasty.

Methods

For this study, the required sample size was calculated using G*Power 3.1 software. Based on a previous study evaluating the mean change in Demodex density using a similar methodology, the effect size was determined to be 0.59 [11]. Assuming a statistical power of 90% and a significance level of 5%, the minimum required sample size was calculated as 33 participants. This prospective cohort study included 40 consecutive patients aged 18 and older who were evaluated at the Otorhinolaryngology Clinic and scheduled for septorhinoplasty surgery. Patients receiving any treatment that could aggravate acne such as systemic or topical steroids, or lithium, those with a history of systemic isotretinoin use, and individuals with systemic diseases such as diabetes mellitus, collagen tissue diseases, thyroid disorders, or immunosuppressive conditions were excluded from the study.

All patients included in the study underwent open technique septorhinoplasty performed by an otorhinolaryngology specialist. Following local site preparation, a Goodman incision was made. The procedure involved elevating the columellar skin over the lower lateral cartilages, then lifting the nasal dorsum skin to perform the appropriate surgical intervention based on the patient's pathology. After the surgery, the skin incision was sutured using 6.0 Prolene, followed by the application of a nasal pack and an external thermal splint. Postoperatively, an antibiotic (oral cefdinir) and a non-steroidal anti-inflammatory drug were administered for 10 days. Nasal packs were removed between postoperative days 2 and 5. The external splint was removed 10 days after surgery. Following splint removal, the otorhinolaryngologist applied adhesive tape every other day for 10 days. Facial cleansing was permitted after splint removal.

The age, sex, accompanying skin disease with face involvement, and thickness of the nasal skin envelope of the patients were recorded. The patients were evaluated by the same dermatologist one day before the surgery and at the third month after the surgery. Dermatological findings

observed in the facial region (erythema, xerosis, follicular spinous projections, papule, pustule, and nodule) were documented.

Samples taken from the bilateral cheeks and nose using the standardized skin surface biopsy technique (SSSBT) were examined for Demodex density [12]. The SSSBT is a simple, noninvasive method that can be easily used in daily practice. In this method, the area to be sampled and the slide are first wiped with alcohol to enhance adhesion. A drop of cyanoacrylate adhesive is placed on the slide, and after waiting 3–4 seconds for it to spread and dry, the slide is attached to the skin area to be sampled. After 1–2 minutes, the slide is gently lifted. A drop of immersion oil is placed on the slide, and after covering it with a coverslip, a 1 cm² area is marked and examined under a light microscope. The live and dead mites, as well as the mite eggs in the marked area, were counted and recorded. The presence of more than five mites per 1 cm² was considered Demodex-positive [4]. The highest Demodex count among the samples taken was accepted as the final Demodex density.

Patients with an increased Demodex density without any clinical findings were classified as having increased Demodex density, while those with accompanying clinical findings (erythema, follicular spinous projections, papules, pustules, or nodules) were diagnosed with demodicosis. Demodicosis is classified according to four clinical types (pityriasis folliculorum, papulopustular, acne-like, and perioral dermatitis-like) [13].

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 23.0 (Chicago, IL, USA). Descriptive statistics are expressed as the mean and median, and number and percentage. The Shapiro-Wilk test was used to evaluate the normality of the data distribution. The Wilcoxon and McNemar tests were used to compare changes in non-normally distributed and nominal variables. Pearson's chi-square test was used to evaluate the relationships between the categorical variables. A p-value of <0.05 was considered statistically significant.

Results

This study included 29 female patients (72.5%) and 11 male patients (27.5%), with a mean age of 26.25±7.47 years. The nasal skin envelope was of medium thickness in 34 patients (85%), thin in three patients (7.5%), and thick in three patients (7.5%). While 23 patients (57.5%) had no skin disease, seven patients (17.5%) had acne vulgaris, seven patients (17.5%) had rosacea, and three patients (7.5%) had seborrheic dermatitis. Additionally, 11 patients (27.5%) had allergic rhinitis, and four patients (10%) had nasal polyps (Table 1).

When evaluating dermatological findings on the face, no significant difference was found between the preoperative

Table 1. Demographic and clinical characteristics of the patients.

Age, years, mean±SD	26.25±7.47
Sex, N (%)	29 (72.5%)
Female	11 (27.5%)
Male	
Nasal skin envelope, N(%)	
Thick	3 (7.5%)
Medium	34 (85%)
Thin	3 (7.5%)
Allergic rhinitis, N(%)	11 (27.5%)
Nasal polyps, N(%)	4 (10%)
Facial skin disease, N(%)	
Acne vulgaris	7 (17.5%)
Rosacea	7 (17.5%)
Seborrheic dermatitis	3 (7.5%)

and postoperative periods in terms of erythema, xerosis, follicular spinous projections, papules, and nodules. However, the presence of seborrhea and pustules significantly increased after surgery ($P<0.001$ and $P=0.016$, respectively) (Table 2).

Before surgery, papulopustular demodicosis was detected in one patient (2.5%), whereas in the third month after surgery, demodicosis was observed in 10 patients (25%): two patients with pityriasis folliculorum and eight patients with papulopustular demodicosis. While an increase in Demodex density was observed in one patient (2.5%) before surgery, it was detected in four patients (10%) after surgery (Table 2). In nine patients who developed demodicosis after rhinoplasty, the related symptoms were observed to emerge at an average of 22.78±9.39 days postoperatively (ranging from the 10th to the 40th day).

The increase in the prevalence of demodicosis after surgery was statistically significant ($P=0.04$). A statistically significant increase in the number of Demodex mites on the face was observed after surgery compared to before surgery ($P=0.001$) (Table 2, Figure 1).

In the patient with an increased Demodex density on the face before surgery, pityriasis folliculorum-type demodicosis developed after surgery. Before surgery, papulopustular demodicosis was detected in one patient, which persisted after surgery.

No significant relationship was found between the change in the number of Demodex mites on the face after surgery and the patients' age, sex, nasal skin envelope thickness, allergic rhinitis, nasal polyps, or accompanying facial skin disease ($P=0.884, 0.59, 0.855, 0.691, 2.124, 0.61$, respectively).

Discussion

The pathogenesis of demodicosis is complex and involves multiple factors, including mite-induced mechanical damage,

Table 2. Comparison of facial dermatological findings and Demodex density before and after surgery.

	Before	3 rd month	<i>p</i>
Dermatological findings, N			
Seborrhea (present/absent)	11/29	27/13	<0.001†
Erythema (present/absent)	7/33	11/29	0.125†
Xerosis (present/absent)	0/40	2/38	0.5†
Follicular spinous projections (present/absent)	0/40	2/38	0.5†
Papule (present/absent)	7/33	12/28	0.125†
Pustule (present/absent)	1/39	8/32	0.016†
Nodule (present/absent)	0/40	0/40	>0.9†
Demodex parasite number			
Right cheek	0 (0-5)	0 (0-19)	0.001*
Left cheek	0 (0-7)	0 (0-24)	0.001*
Nose	0 (0-5)	0 (0-10)	0.005*
Final	0 (0-7)	0 (0-24)	0.001*
Increased Demodex density, N			0.375†
Present	1 (2.5%)	4 (10%)	
Absent	39 (87.5%)	36 (90%)	
Demodicosis, N			0.004†
Present	1 (2.5%)	10 (25%)	
Absent	39 (87.5%)	30 (75%)	

*Wilcoxon test, †McNemar test

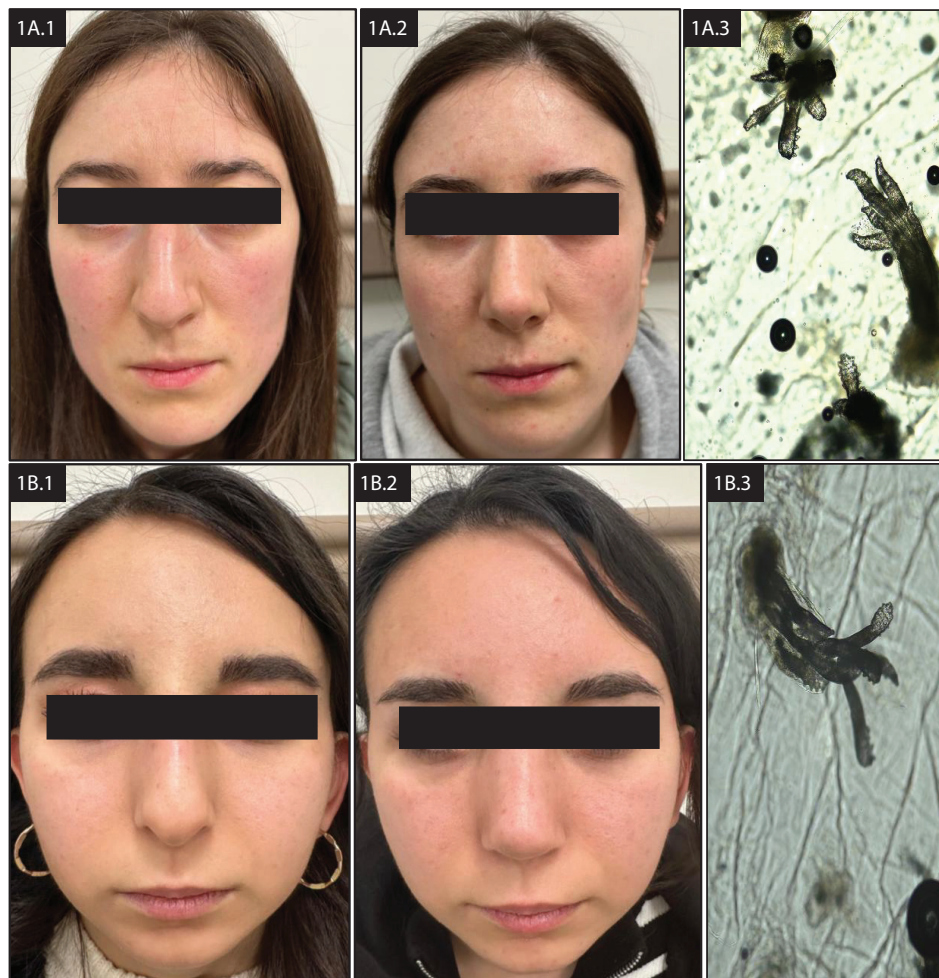


Figure 1. Clinical photographs of two patients diagnosed with demodicosis at postoperative month 3, showing preoperative (1A.1, 1B.1) and postoperative images (1A.2, 1B.2), along with an increase in Demodex density detected in standardized skin surface biopsies taken at month 3 (40x magnitude) (1A.3, 1B.3). At third postoperative month, facial erythema and small pustules were observed (1A.2, 1B.2).

follicular obstruction, increased sebum accumulation, bacterial overgrowth, and immune dysregulation [14,15]. Various studies have reported an association between demodicosis and several diseases and conditions that cause systemic and localized immunosuppression in the skin. Multiple case reports and case series have demonstrated the development of demodicosis following the use of topical steroids and calcineurin inhibitors [16-18]. It has been observed that facial dermatoses related to Demodex occur in patients with AIDS. An increased Demodex density has been detected in leukemia and lymphoma patients undergoing chemotherapy and in individuals receiving immunosuppressive treatment for various dermatological conditions [11,19,20].

To date, only one study has investigated the relationship between surgical rhinoplasty and Demodex. That study compared 50 patients who underwent surgical rhinoplasty within the preceding six months with 50 healthy controls. Demodex density in the nose ($P=0.0001$), the clinical presence of xerosis ($P=0.046$), and pustule frequency ($P=0.001$) were found to be significantly higher in the rhinoplasty group compared to the control group. No significant difference was found between the two groups regarding Demodex density in the malar region, erythema, follicular spiny protrusions, papules, or nodules. In that study, rhinoplasty patients were evaluated for facial symptoms and findings before and after surgery. It was determined that postoperative itching, acne-like eruptions, and a sensation of dryness increased compared to the preoperative period. The authors suggested that topical steroids recommended to reduce postoperative edema, surgical stress, and postoperative skin dryness may have contributed to an increase in Demodex density [21].

In contrast to that previous study, ours evaluated the same patients before and after rhinoplasty. Similar to that study, we found a significant increase in facial Demodex density and pustule frequency after rhinoplasty. Differing from that study, we observed a significant increase in Demodex density in both the nasal and malar regions. Furthermore, the previous study did not provide data on the clinical presence of demodicosis. In our study, the prevalence of demodicosis was also found to have significantly increased after rhinoplasty. Additionally, we observed that clinical findings associated with demodicosis, including facial erythema, xerosis, follicular spiny protrusions, papules, and pustules, increased following rhinoplasty. However, only the increase in pustule frequency was found to be statistically significant.

In the English literature, only one case has been reported of demodicosis developing after surgical rhinoplasty. A 29-year-old female patient presented to the otolaryngology outpatient clinic on the 16th postoperative day with complaints of severe facial itching, burning-stinging sensation, redness, and acne, and was referred to dermatology. Dermatological examination revealed widespread erythema,

scaling, and papulopustular lesions on the entire face except for the periorbital and perioral regions. Microscopic examination of standardized skin surface biopsies taken from the nose, forehead, and cheeks showed a Demodex density exceeding 5 per cm^2 in all areas, leading to a diagnosis of demodicosis. It was reported that the patient's symptoms resolved after one month of topical treatment [22].

Additionally, a 27-year-old female patient who presented on the fifth postoperative day with severe facial itching and burning was reported. Initially, she was diagnosed with contact dermatitis and prescribed topical steroids. However, her symptoms worsened with that treatment, and she was subsequently diagnosed with rosacea. A dermatological examination revealed widespread erythema and pustules; however, the patient was not evaluated for Demodex infestation. It was noted that all her symptoms completely resolved after two months of treatment [10]. It is well known that an increase in Demodex density can exacerbate rosacea, which is a chronic inflammatory skin disease [3,14]. Perhaps the underlying cause of the clinical presentation in this case was an increase in Demodex density following rhinoplasty.

Since surgical rhinoplasty affects the skin-soft tissue envelope surrounding the nose, various postoperative skin changes may occur, including acne, desquamation, ecchymosis, eyebrow loss, hyperpigmentation, scar formation, skin necrosis, seborrhea, and telangiectasia [5-10]. In a study evaluating the frequency of acne development and exacerbation after septorhinoplasty, acne developed in 42.9% of cases, while 27% experienced an exacerbation of pre-existing acne by the first month. The authors suggested that surgical stress, inadequate facial cleansing during the postoperative period, and the use of adhesive tapes could have contributed to acne formation [7].

Another study evaluated 30 septorhinoplasty and 20 septoplasty patients for acne and seborrheic dermatitis preoperatively and postoperatively at day 10 and months 1, 3, 6, and 12. The study results reported that the severity of both acne and seborrheic dermatitis was significantly higher in the septorhinoplasty group. This increase began around the 10th postoperative day, peaked in the first month, and gradually decreased after the third month. The authors suggested that several factors may have contributed to acne development following septorhinoplasty. These include severe postoperative inflammation, skin trauma during surgery, proliferation of *Propionibacterium acnes*, and stress-induced upregulation of corticotropin-releasing hormone (CRH), which stimulates sebaceous activity. The use of topical corticosteroids in the postoperative period was also considered a potential contributing factor [5].

In another study measuring sebum levels in nasal skin before and after rhinoplasty, a significant postoperative increase in sebum production was observed in both dry and oily skin

types [6]. In our study, we found a significant increase in the number of facial Demodex mites and the frequency of demodicosis following septorhinoplasty. We hypothesize that this increase may be associated with immunosuppression induced by CRH elevation due to surgical stress, disruption of skin integrity following the procedure, adhesive tape application, reduced frequency of facial cleansing in the postoperative period, and increased seborrhea observed after surgery. Previous studies have reported the development and exacerbation of acne following surgical rhinoplasty [5-7]. Acne is a dermatological condition characterized by erythematous papules and pustules on the face [3]. In our study, the papulopustular demodicosis was predominantly observed. Therefore, we suggest that some previously reported cases of postoperative acne may have been demodicosis.

Although our study focused on septorhinoplasty, the observed increase in Demodex density and demodicosis prevalence may also occur after other midfacial surgeries, such as facial fracture repair, maxillofacial reconstruction, or tumor resection. These procedures often involve similar postoperative conditions such as surgical trauma, skin barrier disruption, hormonal changes (e.g., CRH and ACTH elevation) [23,24], the use of adhesive dressings, and reduced facial cleansing, each of which has been linked to increased Demodex proliferation [4,14,21]. Therefore, we hypothesize that any midfacial procedure that induces similar physiological and behavioral postoperative conditions may create a favorable microenvironment for Demodex overgrowth and the subsequent development of demodicosis. Further comparative studies involving different types of midfacial surgeries are warranted to determine the generalizability of our findings.

In light of our findings, certain preventive and therapeutic measures may help minimize postoperative demodicosis in patients undergoing septorhinoplasty. A preoperative dermatological evaluation may identify patients with pre-existing facial dermatoses or high Demodex density who are at greater risk. Postoperative hygiene instructions should emphasize regular and gentle facial cleansing, particularly after the removal of splints and adhesive tapes. Cautious and time-limited use of topical corticosteroids is advised, given their potential to promote local immunosuppression and mite proliferation. In patients with persistent or worsening erythema, papules, or pustules, early dermatological consultation should be considered. Topical treatments such as metronidazole, ivermectin, and permethrin have shown efficacy in treating demodicosis and may be initiated when appropriate [2].

The strengths of our study include the prospective evaluation of the same patients before and after surgery and the confirmation of demodicosis diagnosis through SSSBT. This study has several limitations, however. It was conducted at

a single center without a separate control group, and it did not assess potential confounders such as makeup use, facial cleansing habits, or pet ownership [4]. The three-month follow-up period may have been insufficient to capture long-term changes. Although surgeries were performed by a single surgeon, variations in technique and postoperative care may have introduced some heterogeneity. Additionally, dermatological assessments were conducted only at the third postoperative month and were not blinded, which may have led to missed early symptoms and observer bias.

Conclusions

In patients presenting with erythema, papules, and pustules on the face in both the early and late postoperative periods after septorhinoplasty, demodicosis should be considered in the differential diagnosis, and the necessary diagnostic investigations should be conducted.

However, further large-scale studies with a larger number of patients are needed to validate our findings and comprehensively examine the factors influencing the postoperative increase in Demodex density, including lifestyle-related variables such as facial cleansing habits, cosmetic use, and other potential confounders.

Ethics Committee: The present study was conducted according to the Declaration of Helsinki and approved by the Clinical Research and Ethics Committee linked to Giresun Training and Research Hospital Giresun Training and Research Hospital (approval number: 23.10.2023/18, date: 23.10.2023).

Consent to Participate: Informed consent was obtained from all individual participants included in the study.

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