“MICRODEBRIDER- ASSISTED TURBINOPLASTY VERSUS COBLATION METHOD OF TURBINOPLASTY

- A COMPARATIVE STUDY”

Submitted by

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LIST OF ABBREVATIONS

Abbreviation	Full Form
MAT	Microdebrider-Assisted Turbinoplasty
CAT	Coblation-Assisted Turbinoplasty
NOSE	Nasal Obstruction Symptom Evaluation
PNIF	Peak Nasal Inspiratory Flow
VAS	Visual Analog Scale
SD	Standard Deviation
CT	Computed Tomography
MRI	Magnetic Resonance Imaging
SMR	Submucosal Resection
DNS	Deviated Nasal Septum
ENT	Ear, Nose, and Throat
OPD	Outpatient Department
MTT	Mucociliary Transit Time
ANOVA	Analysis of Variance
IQR	Interquartile Range
CI	Confidence Interval
H&E	Hematoxylin and Eosin
Hb	Hemoglobin
HR	Heart Rate
BP	Blood Pressure
ASA	American Society of Anesthesiologists
RF	Radiofrequency
NS	Not Significant
NSS	Non-Significant Difference
RCT	Randomized Controlled Trial
ICC	Intraclass Correlation Coefficient
SE	Standard Error
SD	Standard Deviation
SEM	Standard Error of Mean

ROC	Receiver Operating Characteristic
AUC	Area Under Curve
LSR	Lateralized Septal Rotation
FESS	Functional Endoscopic Sinus Surgery

ABSTRACT

Introduction

Inferior turbinate hypertrophy is a major cause of chronic nasal obstruction, significantly impairing nasal airflow and overall quality of life. Although medical management with antihistamines, decongestants, and corticosteroids is the first line of treatment, a subset of patients remains symptomatic and requires surgical intervention. Various surgical techniques, including partial turbinectomy, turbinoplasty, and submucosal tissue reduction, have been developed to improve nasal patency while preserving mucosal function. Microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT) are two widely used mucosa-sparing techniques. However, limited comparative studies exist evaluating their efficacy, safety, and long-term outcomes. This study aims to compare the clinical outcomes of MAT and CAT in the surgical management of inferior turbinate hypertrophy.

Methods

This prospective comparative study included 60 patients diagnosed with symptomatic inferior turbinate hypertrophy unresponsive to medical therapy. Patients were randomly assigned to undergo either MAT (n = 30) or CAT (n = 30) under general anesthesia. In the MAT group, a microdebrider was used for submucosal tissue removal and turbinate lateralization, while in the CAT group, controlled radiofrequency ablation was performed using a coblator wand before out-fracturing the turbinate. Postoperative outcomes were assessed using the Nasal Obstruction Symptom Evaluation (NOSE) score and objective airflow measurements at 1 month, 3 months, and 6 months postoperatively. Intraoperative bleeding, postoperative healing, and complications were also evaluated.

Results

Both MAT and CAT showed significant improvements in NOSE scores, with mean scores improving from 72.4 ± 8.6 preoperatively to 18.7 ± 4.2 at 6 months in the MAT group, and from 73.1 ± 7.9 to 19.3 ± 5.1 in the CAT group ($p > 0.05$). Peak nasal inspiratory flow (PNIF) improved by 62.3% in the MAT group and 58.7% in the CAT group at 6 months ($p > 0.05$). Intraoperative blood loss was slightly lower in the CAT group (21.5 ± 5.2 mL vs. 27.8 ± 6.4 mL in MAT, $p < 0.05$). Postoperative crusting and healing times were comparable between the two groups, with no significant difference in complication rates or recurrence of turbinate hypertrophy.

Conclusion

MAT and CAT are both effective and safe surgical options for managing inferior turbinate hypertrophy. While CAT offers a slight advantage in intraoperative hemostasis, both techniques provide comparable symptom relief, nasal airflow improvement, and mucosal preservation, making either a viable choice based on surgeon preference and patient-specific factors.

Keywords

Inferior turbinate hypertrophy, microdebrider-assisted turbinoplasty, coblation-assisted turbinoplasty, nasal obstruction, turbinate reduction, NOSE score, mucosal preservation.

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INTRODUCTION

Inferior turbinate hypertrophy is one of the most common causes of chronic nasal obstruction in patients seeking treatment at outpatient clinics. The inferior turbinates play a critical role in regulating nasal airflow, conditioning inspired air by filtering, warming, and humidifying it. However, when hypertrophied, they contribute significantly to nasal obstruction, leading to symptoms such as mouth breathing, dryness of the oral mucosa, nasal resonance changes, disturbed sleep, and reduced pulmonary function[1]. Turbinate hypertrophy is commonly associated with allergic rhinitis, vasomotor rhinitis, and chronic hypertrophic rhinitis. While medical management, including antihistamines, topical decongestants, and corticosteroids, is the first-line treatment, some patients remain refractory to these interventions and experience persistent nasal obstruction despite optimal medical therapy[2].

In cases where medical treatment fails to provide relief, surgical reduction of the inferior turbinate is necessary to improve nasal patency. A variety of surgical techniques are available to reduce the volume of both the mucosal and bony components of the inferior turbinate. These include cryosurgery, electrocautery, total or partial turbinectomy, turbinoplasty, and submucosal turbinectomy[3]. While these procedures generally yield satisfactory outcomes, they are also associated with postoperative complications such as bleeding, crust formation, pain, foul odor, synechiae formation, and in some cases, atrophy of the inferior turbinates[4]. Additionally, procedures performed with traditional headlight illumination often fail to address hypertrophy at the posterior end of the turbinate, leading to persistent nasal obstruction in some cases. Although more aggressive surgical techniques, such as total or near-total turbinectomy, may offer more long-term relief, they carry a higher risk of complications, including excessive mucosal loss and empty nose syndrome[5].

To overcome these limitations, less destructive endoscopic procedures have been developed, utilizing advanced energy-based technologies such as lasers and radiofrequency to enhance precision and minimize trauma. Among these, radiofrequency ablation has gained widespread adoption due to its ability to effectively reduce submucosal turbinate volume while preserving the overlying mucosa, resulting in fewer postoperative complications and improved patient tolerance[6]. However, the ideal surgical technique for turbinate reduction remains unsettled, as each approach varies in its ability to balance the need for effective volume reduction while minimizing adverse effects such as bleeding, crusting, and prolonged recovery[7].

An optimal turbinate reduction procedure should address both the erectile submucosal tissue and the bony turbinate. While reducing the bony framework increases nasal airflow by enlarging the intranasal space, targeted submucosal tissue remodeling minimizes future mucosal engorgement. Additionally, preservation of the mucosal lining is essential for maintaining the physiological functions of the turbinates, including humidification, filtration, and temperature regulation[8]. Recent advancements have led to the increasing use of two mucosal-sparing techniques: microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT). These approaches have been developed to selectively remove hypertrophic tissue while preserving mucosal integrity, reducing complications, and improving long-term outcomes[9].

Turbinoplasty aims to remove the non-functional, obstructive portion of the turbinate while preserving the medial mucosa, which plays a primary role in conditioning inhaled air. Unlike more aggressive turbinectomy procedures, turbinoplasty provides a balanced approach by maintaining mucosal integrity while effectively reducing turbinate bulk. The intraturbinal method, which is commonly used in MAT and CAT, primarily removes submucosal erectile tissue, leaving the bony inferior turbinate relatively intact. However, since the bony hypertrophy of the inferior turbinate also contributes to nasal obstruction, a modification known as the extraturbinal method has been developed. This approach combines the soft tissue resection of submucosal resection (SMR) with partial bony turbinate resection to enhance nasal airflow without compromising mucosal function[7,10].

Microdebrider-assisted turbinoplasty (MAT) has gained popularity for its ability to provide precise tissue removal while minimizing trauma. The technique uses a powered microdebrider, which allows controlled resection of hypertrophic turbinate tissue under endoscopic guidance[11]. The microdebrider is commonly employed for extraturbinal procedures, where it selectively removes both hypertrophic soft tissue and portions of the inferior turbinate bone while sparing the overlying mucosa. This technique has demonstrated excellent postoperative outcomes in terms of nasal patency, with reduced complications compared to traditional turbinectomy[12].

Coblation-assisted turbinoplasty (CAT), on the other hand, utilizes bipolar radiofrequency energy to ablate submucosal hypertrophic tissue while preserving the overlying mucosa. Unlike conventional electrocautery, which operates at high temperatures and carries a greater risk of thermal damage, coblation technology operates at lower temperatures (40–70°C), reducing the risk of mucosal injury, crusting, and prolonged healing[13]. While coblation has been primarily used for intraturbinal procedures, its potential in extraturbinal applications remains relatively underexplored.

Despite the growing clinical adoption of MAT and CAT, a direct comparative analysis of their postoperative outcomes remains limited in the literature. While both techniques aim to achieve effective turbinate reduction with minimal complications, their relative efficacy, safety profiles, and long-term outcomes remain areas of ongoing investigation. Some studies suggest that MAT provides greater immediate airway relief due to mechanical tissue removal, while CAT may offer a more controlled, hemostatic approach with reduced intraoperative bleeding. However, the overall impact on long-term symptom relief, mucosal healing, and patient satisfaction has not been adequately compared[14].

Given the absence of a clear consensus on the superior technique, this study aims to compare the effectiveness and safety of microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT) in the treatment of inferior turbinate hypertrophy resistant to medical therapy. By evaluating key surgical outcomes, including postoperative nasal obstruction relief, mucosal healing, complication rates, and patient satisfaction, this study seeks to provide evidence-based insights to determine the optimal surgical approach for patients requiring turbinate reduction.

AIMS AND OBJECTIVES

AIM

To compare the effectiveness and safety of microdebrider-assisted turbinoplasty and coblation-assisted turbinoplasty in the management of inferior turbinate hypertrophy resistant to medical therapy.

OBJECTIVES

1) To compare the efficacy between microdebrider-assisted turbinoplasty and coblation -assisted turbinoplasty in a turbinate reduction in reducing the nasal obstruction

2) To compare the intra operative bleeding , intra operative time ,degree of postoperative complications between microdebrider and coblation.

REVIEW OF LITERATURE

1. Embryology

The embryological development of the nasal turbinates is a highly intricate process that begins early in gestation and involves contributions from the ectoderm, mesenchyme, and neural crest cells. At approximately four weeks of gestation, the nasal placodes emerge as ectodermal thickenings on the frontonasal prominence. These placodes invaginate to form the nasal pits, which later give rise to the nasal cavities. By the fifth week, the surrounding mesenchymal tissue proliferates, creating the medial and lateral nasal processes, which contribute to shaping the nasal structures. The nasomedial processes eventually merge to form the intermaxillary segment, giving rise to the primary palate, the tip of the nose, and parts of the nasal septum[15]. The lateral nasal wall develops by the eighth week, exhibiting soft tissue elevations termed **pre-turbinates**, which correspond to the future inferior, middle, and superior turbinates. These structures appear as ridges that will later ossify to form definitive bony projections within the nasal cavity[16].

By the ninth to tenth weeks of gestation, the cartilaginous nasal capsule extends into the developing turbinates, providing an early scaffold for their growth. The **inferior turbinate**, derived from the maxilloturbinal, undergoes ossification around the seventeenth to eighteenth week, making it the earliest to ossify. The **middle turbinate** originates from the second ethmoturbinal ridge and begins ossification at approximately the twentieth week. The **superior turbinate** develops from the third and fourth ethmoturbinals, undergoing ossification after the twenty-first week, while the **supreme turbinate**—which is not present in all individuals—derives from the fourth and fifth ethmoturbinals[17]. During these stages, the olfactory fascia plays a role in guiding turbinate formation, further influencing the nasal cavity's structural development. By twenty-four weeks, the lateral nasal wall is nearly complete, with the major turbinates fully formed and their ossification progressing. However, the nasal cavity continues to mature throughout fetal development, refining the structures necessary for respiratory and olfactory functions[16].

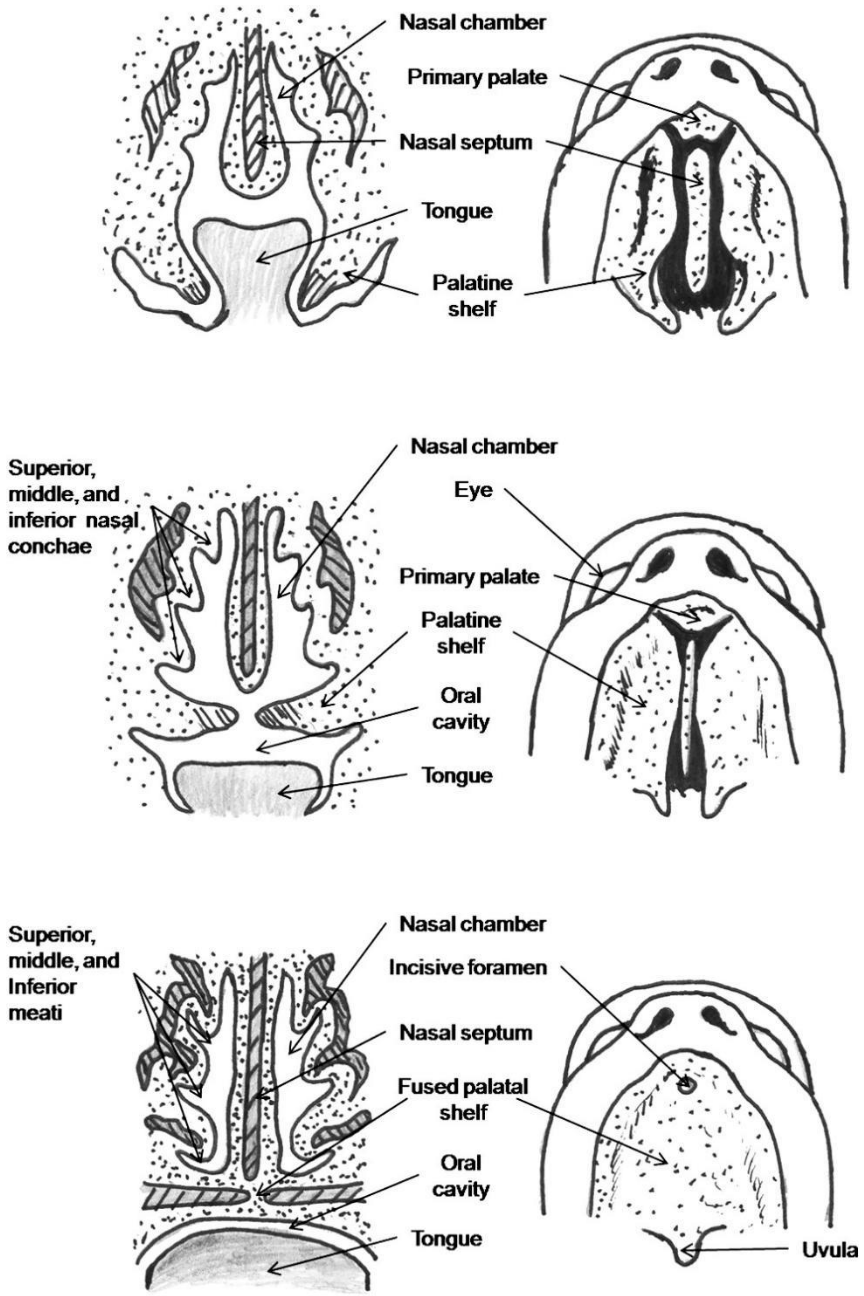


Figure 1 Embryogenic development of the nasal cavity from Neskey et al. (2009), has been included with the necessary permissions for reference[15]

From an evolutionary standpoint, the development of the nasal turbinates represents an adaptation for dual respiratory and olfactory functions. The **olfactory placodes** give rise to the ethmoturbinals, which are specialized for olfaction, while the **maxillary processes** contribute to the formation of the maxilloturbinals, which assist in regulating airflow and humidification. The lateral masses of the ethmoid bone, which give rise to the superior and middle turbinates, result from the evolutionary remodeling of palatal bones[18]. The evo-devo perspective highlights how the respiratory and olfactory noses evolved as separate entities before merging to form the modern nasal anatomy in vertebrates. In mammals, this results in highly specialized structures that optimize airflow regulation, air humidification, and the detection of odorants[19]. Comparative embryological studies on various mammalian species further reveal that nasal turbinals originate as mesenchymal condensations that later undergo **endochondral ossification**, forming the intricate bony structures observed in adults. These studies emphasize that despite interspecies variations, the fundamental developmental pattern remains highly conserved across vertebrates[19].

Thus, the development of nasal turbinates is a meticulously regulated process that ensures optimal respiratory and olfactory functions. The transition from mesenchymal condensations to fully ossified structures enables the nasal cavity to function efficiently in air filtration, humidification, and olfaction. The evolutionary perspective further reinforces the significance of turbinates in vertebrate adaptations, demonstrating how their structure has been refined over time to meet the physiological demands of different species. The embryological and evolutionary insights into turbinate development provide a deeper understanding of their anatomical complexity and clinical significance[15].

2. Anatomy of the turbinates/conchae

In the intricate architecture of the nasal cavity, the turbinates stand as pivotal structures regulating airflow and maintaining optimal respiratory function. Located along the lateral walls of the nasal cavity are three pairs of turbinates: the superior, middle, and inferior turbinates[20]. Additionally, between 8% and 80% of individuals may have either a unilateral or bilateral supreme turbinate[21]. The bony structures of the turbinates are known as conchae. The conchae of the middle, superior, and supreme turbinates are extensions of the ethmoid bone, whereas the inferior turbinate, which is the largest, is an independent bone. Below the attachment of each turbinate to the lateral nasal wall is a space called a meatus. These meatuses serve as drainage pathways for various outflow tracts from the orbits and paranasal sinuses. Turbinates are crucial for warming and humidifying the air we inhale and for regulating nasal airflow. However, they can also significantly contribute to nasal airway obstruction, especially in cases of allergies and viral upper respiratory infections[20].

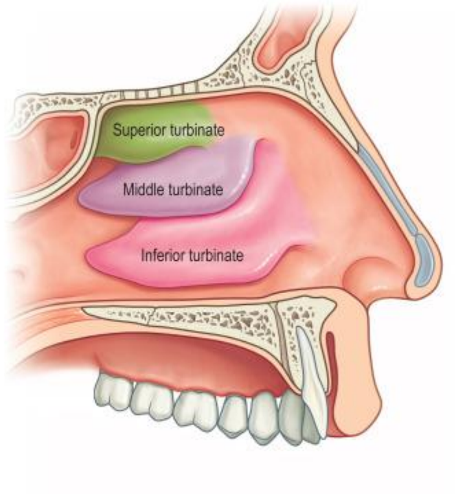


Figure 2 Nasal Anatomy from Nasal Anatomy and Physiology by Andrew P. Lane, has been included with the necessary permissions for reference.

2.1. Surfaces and borders of Inferior Turbinate

Moving to the inferior nasal concha, it distinguishes itself as the largest and broadest among the three conchae, formed independently by its own bone. Its inner surface is coated with a mucous membrane containing sizable vascular spaces capable of adjusting to regulate nasal cavity width. Functionally, the inferior nasal concha contributes to the formation of two nasal spaces: the middle and inferior nasal meatuses. The inferior nasal meatus, situated beneath the inferior nasal concha and the lateral nasal wall, plays a pivotal role in directing airflow, as well as facilitating humidification, heating, and filtration of inhaled air. Moreover, it serves as a conduit for lacrimal fluid from the nasolacrimal canal via a valve known as Hassner's valve[22].

The upper border of the structure is thin, irregular, and connected to various bones along the lateral wall of the nasal cavity. It can be divided into three portions. The anterior portion articulates with the conchal crest of the maxilla, while the posterior portion connects with the conchal crest of the palatine. The middle portion presents three well-marked processes, which vary significantly in their size and form.

Among these processes, the anterior or lacrimal process is small and pointed, located at the junction of the anterior fourth and the posterior three-fourths of the bone, and assists in forming the canal for the nasolacrimal duct. Behind this process, a broad, thin plate called the ethmoidal process ascends to join the uncinate process. From the lower border of this ethmoidal process, a thin lamina known as the maxillary process curves downward and laterally, articulating with the maxilla and forming a part of the medial wall of the maxillary sinus.

The inferior border of this structure is free, thick, and cellular, especially in the middle portion of the bone. This cellular structure contributes to the overall robustness and functionality of the bone within the nasal cavity.

2.2. Blood Supply of Inferior Turbinate

The inferior turbinate receives its blood supply from the inferior turbinate artery (ITA), which is one of the two terminal branches of the posterior lateral nasal artery (PLNA), itself a branch of the sphenopalatine artery (SPA). The main blood supply enters the turbinate from above, approximately 1-1.5 cm from its posterior border, and then passes forward, giving off a rich anastomotic network of vessels. The ITA courses through the inferior turbinate in a bony canal wrapped by a fascial coat, which binds the artery and the canal tightly together. This anatomical relationship is the primary reason for prolonged bleeding following turbinate surgery, as the fascial coat prevents the ITA from contracting[23].

According to Gil and Margalit (2012), the inferior turbinate is supplied by three arteries: the turbinate branch of the sphenopalatine artery, the anterior ethmoidal artery, and the lateral nasal artery (a branch of the facial artery). This complex vascular supply underscores the importance of careful surgical technique and thorough understanding of the nasal anatomy to manage bleeding and ensure successful outcomes in turbinate surgery[20].

2.3. Physiology in health

The nasal turbinates, which protrude from the lateral nasal walls, play a crucial role in warming and humidifying the air as it travels through the nasal cavity to the lungs. Their curved, shelf-like shape increases surface area for these functions. Among the four types of turbinates—supreme, superior, middle, and inferior—the inferior turbinates emerge as paramount players. The inferior turbinates, in particular, regulate airflow by swelling and contracting to control moisture levels in the nasal cavity. Covered by pseudostratified columnar respiratory epithelium, the turbinates contain a layer of erectile tissue with venous sinusoids that adjust their volume in response to autonomic signals[24].

In most individuals, one inferior turbinate swells while the other contracts, diverting airflow predominantly through one nostril at a time. This alternation, known as the "nasal cycle," varies in duration, lasting from half an hour to six hours, with longer cycles typically occurring during sleep In most individuals, one inferior turbinate swells while the other contracts, diverting airflow predominantly through one nostril at a time. This alternation, known as the "nasal cycle," varies in duration, lasting from half an hour to six hours, with longer cycles typically occurring during sleep[25].

The anatomical structure of the inferior turbinate is closely intertwined with its physiological function. Comprising a bony core enveloped by soft respiratory epithelium, the turbinate's cancellous bone features interwoven trabeculae that house its primary arterial supply. Its folded design significantly amplifies the mucosal surface area of the nasal cavity, reaching up to 200 square centimetres. The mucosal lining consists of a protective pseudostratified columnar epithelium housing predominantly ciliated columnar cells, goblet cells, and basal cells. These components work synergistically: cilia facilitate the mechanical movement of mucous particles, goblet cells secrete substances augmenting the mucous film, and basal cells possess the ability to differentiate into various cell types as required. Additionally, immune cells like mast cells, eosinophils, and lymphocytes are present within the mucosal layer. Beneath the epithelial mucosa lies the submucosa, housing three glands responsible for the bulk of nasal secretions, alongside inflammatory mediators. Furthermore, the complex autonomic nervous system regulating nasal function is also situated here[24].

3. Physiology of Nasal Cycle

The nasal cycle is a spontaneous, reciprocal congestion and decongestion of the nasal mucosa occurring alternately between the two nostrils throughout the day. First described by Richard Kayser in 1895, it is observed in approximately 70-80% of healthy adults, though a true periodic pattern exists in only 21-39% of individuals[26]. This cycle is governed by the autonomic nervous system, specifically by alternating sympathetic and parasympathetic activity. Sympathetic activation leads to vasoconstriction and decongestion in one nostril, while the contralateral nostril experiences parasympathetic-induced vasodilation and congestion[27]. The hypothalamus is believed to act as the central regulator of the nasal cycle, coordinating these autonomic shifts and maintaining an overall balance in nasal airflow[28].

The nasal cycle plays a crucial role in air conditioning and humidification of inspired air, allowing one nostril to remain relatively congested, thereby accumulating epithelial fluid while the other nostril facilitates airflow. This ensures optimal humidification and warming of inspired air before it reaches the lungs[27]. The cycle also contributes to mucociliary clearance, where alternating congestion patterns create a pumping mechanism that enhances the transport of mucus and trapped pathogens, improving defence against infections. The frequency and amplitude of the nasal cycle may increase during respiratory infections, facilitating plasma exudation rich in immunoglobulins and inflammatory mediators[26].

Another significant function of the nasal cycle is its impact on olfactory perception. It has been proposed that alternating airflow patterns optimize odour detection by enhancing high-solubility odorant perception in one nostril and low-solubility odorant perception in the other, effectively broadening the olfactory range[29]. Additionally, studies suggest that the nasal cycle is linked to brain lateralization, with right nostril dominance correlating with left hemisphere activation and left nostril dominance stimulating the right hemisphere. This relationship is believed to influence cognitive function, autonomic tone, and stress regulation[26].

The periodicity of the nasal cycle varies significantly among individuals, with cycle durations ranging from 30 minutes to 6 hours, and an average of 2–4 hours[29]. Several physiological and environmental factors influence the cycle. Age-related changes impact its regularity, with neonates exhibiting an absent or weak cycle that develops as the autonomic nervous system matures. In elderly individuals, the rhythmicity of the cycle diminishes due to reduced vascular elasticity[26]. Sleep stages also play a role, as the majority of nasal cycle shifts occur during REM sleep, suggesting a correlation between nasal airflow regulation and sleep physiology. Body posture affects the cycle as well, with lateral recumbency causing increased congestion in the dependent nostril due to gravitational effects[29]. Physical exercise suppresses the nasal cycle, leading to bilateral nasal airflow increase due to sympathetic vasoconstriction, while hormonal fluctuations, particularly estrogen surges during ovulation and pregnancy, can alter congestion patterns[28].

Clinically, recognizing the nasal cycle is essential in diagnosing nasal obstruction disorders. Conditions such as chronic rhinitis, allergic rhinitis, and deviated nasal septum can affect the duration, amplitude, and symmetry of the cycle[28]. Disruptions in the cycle have also been observed in autonomic disorders, neurological conditions such as Parkinson's disease and schizophrenia, and sleep apnoea, further emphasizing its importance in systemic physiology. Additionally, studies suggest that the nasal cycle influences cardiovascular parameters such as heart rate, blood pressure, and intraocular pressure, indicating a broader role in autonomic regulation[29].

In summary, the nasal cycle is a highly regulated physiological process that ensures optimal respiration, mucociliary clearance, and olfaction while maintaining autonomic balance. Although its periodicity and amplitude vary across individuals, its fundamental role in airway physiology and systemic homeostasis is well established. Understanding the nasal cycle is essential not only for diagnosing nasal airflow disorders but also for exploring its broader implications in neurological function, cognition, and cardiovascular regulation[27].

4. Inferior turbinate hypertrophy

In instances of sinus infections, allergies, or abrupt temperature fluctuations, these turbinates may undergo inflammation or shrinkage, impacting nasal airflow and overall comfort. Indeed, turbinate dysfunction, to varying degrees, is a common experience for individuals throughout their lives, underscoring the critical role of these nasal structures in respiratory health. Turbinate hypertrophy, a condition characterized by chronic inflammation and enlargement of the inferior turbinates, poses significant challenges to nasal breathing. In response to triggers like sinus infections, allergies, or fluctuations in environmental temperature, the inferior turbinates may undergo inflammation or shrinkage, leading to compromised airflow. It's noteworthy that virtually everyone experiences some degree of turbinate dysfunction at various stages of life[30].

The inferior turbinates are dynamic structures integral to the normal function of the nose, yet they are relatively accessible for surgical intervention. Recognized as a common cause of nasal obstruction, various surgical methods have been developed since the mid-19th century to either reduce the size of the turbinates or remove them entirely[31]. Despite a decreasing trend in such surgeries, inferior turbinate reduction remains a frequent procedure in ENT practice. Contemporary otorhinolaryngological literature indicates that the evidence supporting the numerous turbinate reduction techniques is weak[32]. Surgeons typically recommend these procedures based on the primary symptom of nasal obstruction, despite the lack of a universally ideal surgical method[33]. Most techniques provide only short-term relief, and paradoxically, specialist rhinologists, who primarily focus on nasal conditions, seldom perform inferior turbinate surgeries.

4.1. Definition of inferior turbinate hypertrophy

Inferior turbinate reduction surgeries are typically based on the perception that the turbinates are enlarged, a diagnosis often made subjectively and by exclusion when patients report nasal obstruction. Various terms such as hypertrophic, congested, hyperplastic, and engorged are used to describe this condition, reflecting a lack of standardization[34]. In cases of severe rhinitis, significant congestion of the inferior turbinates may be evident. However, it's crucial to recognize that this congestion could be part of the nasal cycle. Therefore, applying a topical decongestant to the inferior turbinates should be considered before diagnosing chronic congestion.

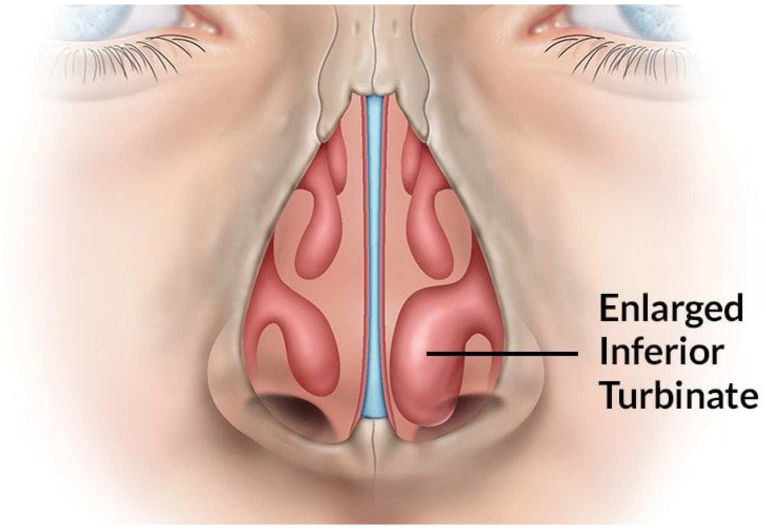


Figure 3 Inferior Turbinate Hypertrophy from AlSharhan et al. (2024), has been included with the necessary permissions for reference[35]

Histological studies of bilaterally enlarged inferior turbinates reveal dilated venous sinuses, subepithelial inflammatory cell infiltration, lamina propria fibrosis, and dilated mucous gland ducts[34]. Additional changes include increased pseudostratified surface epithelium, goblet cells, and mucous gland acini. In patients with non-allergic perennial and allergic rhinitis, non-allergic turbinates show degenerative changes and lamina propria fibrosis, while allergic turbinates exhibit significant tissue edema[36]. Patients with septal deviation and contralateral inferior turbinate enlargement show a two-fold increase in the bony concha compared to cadaver controls. Notably, the mucosa on the medial aspect of the turbinate is thickest in enlarged turbinates[37], suggesting that surgical interventions should target the mucosa over the medial aspect and the vascular sinusoid-rich inferior section[38].

4.2. Pathogenesis of inferior turbinate hypertrophy

When assessing a patient with enlarged inferior turbinates, categorizing the enlargement using the classification proposed by Hol and Huizing can be helpful[39]. The categories are:

1. **Compensatory hypertrophy**: Occurs when the nasal septum deviates to the opposite side, causing the turbinate to fill the empty space.
2. **Protruded turbinate**: The turbinate extends more medially into the nasal cavity, often apparent on coronal CT images where the conchal bone makes a less acute angle with the lateral nasal wall.
3. **Hyperplasia of the turbinate head**: Enlargement of the anterior part of the turbinate, which can obstruct the nasal valve, commonly seen in chronic rhinitis.
4. **Hyperplasia of the whole turbinate**: Involves the entire turbinate length, also associated with chronic rhinitis.
5. **Hyperplasia of the turbinate tail**: Enlargement of the posterior end, often seen in chronic sinusitis and post-nasal discharge.

Patients with rhinitis may experience accentuated effects of the nasal cycle, worsening nasal obstruction, especially in the supine position. Chronic enlargement of the inferior turbinates is common in severe rhinitis or rhinosinusitis, exacerbated by self-medication with decongestants like xylometazoline. Additionally, sarcoidosis, a rare disorder, can cause severe inferior turbinate enlargement and should be considered if typical treatments are ineffective[40].

4.3. Clinical features of inferior turbinate hypertrophy

Patients with enlarged inferior turbinates typically exhibit nasal obstruction. A thorough nasal symptom assessment, along with examination and endoscopy, generally leads to an accurate clinical diagnosis of either allergic or non-allergic rhinitis or chronic rhinosinusitis. The anterior portion of the swollen inferior turbinates may appear as a red swelling or a pale purplish hue, with the latter often indicating severe allergic rhinitis (see Figure 3). This swollen anterior end is readily visible during a nasal examination and is frequently misidentified as an inflamed nasal polyp in primary care settings.

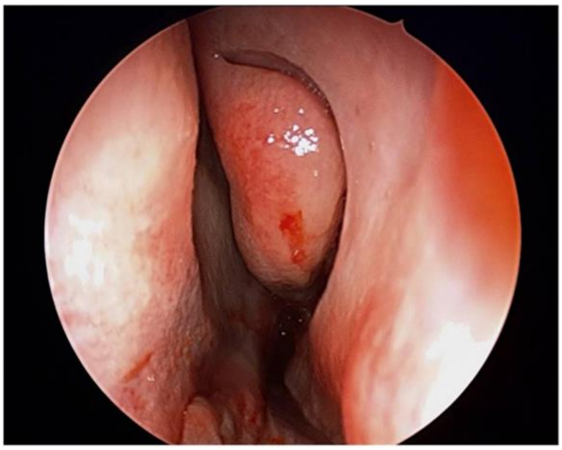


Figure 4 Gross Enlargement of the Right Inferior Turbinate in Allergic Rhinitis from Maharaj et al. (2018), has been included with the necessary permissions for reference[41]

For an optimal examination, the nose should be inspected before and 10 minutes after the application of a mucosal vasoconstrictor. Chronically congested inferior turbinates usually do not decrease in size and remain enlarged, which is a crucial consideration if turbinate surgery is being contemplated. Imaging is generally unnecessary unless surgery for rhinosinusitis is being planned. However, when available, imaging can provide valuable insights into the condition of the turbinates.

CT scans are the preferred imaging technique (refer to Figure 5), though MRI can also offer beneficial information.

Figure 5 Multi-planar CT sinus: enlarged inferior turbinates from Görülen et al. (2014), has been included with the necessary permissions for reference[42]

4.4. Evaluation of the inferior turbinates before surgery

Nasal obstruction is a subjective symptom with a complex and not fully understood pathophysiological mechanism[43]. There is often a discrepancy between the reported severity of nasal obstruction and clinical findings. Therefore, measuring the degree of obstruction is crucial for monitoring the effects of surgical and medical interventions. This can be achieved using a visual analogue scale and the 22-question Sino-Nasal Outcome Test (SNOT-22)[44].

Some departments have access to physiological measuring techniques such as acoustic rhinometry, anterior rhinomanometry, and rhinospirometry. These tools can quantify the degree of obstruction, compare each side of the nose, and assess changes post-surgery. While research settings may take measurements before and after vasoconstriction, in clinical practice, inducing mucosal vasoconstriction in all cases is more practical. Additionally, the overall degree of nasal obstruction can be assessed by measuring the peak nasal inspiratory flow with a specialized nasal spirometer.

Camacho et al. proposed a classification system for grading the size of the inferior turbinate based on its position in the total nasal airway area, as observed during naso-endoscopic examination. According to this system, the inferior turbinate is divided into four grades. Grade 1 corresponds to the inferior turbinate occupying 0 to 25% of the entire airway space. Grades 2 and 3 encompass turbinate sizes ranging from 26% to 50% and 51% to 75% of the airway space, respectively. Grade 4 is defined as the inferior turbinate occupying 76% to 100% of the total airway space. Given the absence of a consensus or standardization regarding the best classification scheme, determining the efficacy of a specific surgical method for reducing inferior turbinate hypertrophy poses challenges and can be confusing. The Camacho classification system is preferred due to its ability to provide a more comprehensive assessment of turbinate size[45].

5. Inferior turbinate reduction

Inferior turbinate reduction is one of the most frequently performed sinonasal surgical procedures, primarily indicated for nasal obstruction due to enlarged inferior turbinates. Besides alleviating nasal obstruction, this procedure may also aid in treating sleep-disordered breathing in both adults and children[46,47]. There are various causes for inferior turbinate enlargement, including physiological, anatomical, and pathophysiological factors such as allergic, vasomotor, and hormonal rhinitis, as well as systemic inflammatory diseases. Therefore, evaluating allergic and other systemic causes is an essential part of the comprehensive medical history for any patient assessed for nasal obstruction.

The physical examination should involve anterior rhinoscopy and nasal endoscopy, both before and after nasal decongestion, to distinguish between bony and soft tissue contributions to turbinate enlargement and associated symptoms. Prior to considering surgical intervention, the typical course of treatment includes medical therapies such as topical nasal steroids, antihistamines, and nasal saline irrigations[48].

Simple system of classifying turbinate operations[49]

A. Mucosal Preservation Surgery

- Lateralization by outfracture
- Mini-microdebrider surgery
- Radiofrequency
- Coblation
- Turbinoplasty
- Submucosal diathermy

B. Mucosal Destructive Reduction Surgery

- Superficial cautery
- Chemocautery with chromic acid or trichloric acid
- Cryosurgery
- Laser surgery
- Direct microdebrider mucosal reduction

C. Turbinate Excision Procedures

- Partial
- Subtotal
- Posterior end

Since the topic of this study is "Microdebrider- versus Coblation-assisted Turbinoplasty - An Observational Study," this literature review will focus on exploring these two surgical techniques in greater detail. Specifically, the review will examine the principles, methodologies, advantages, and outcomes associated with Microdebrider- and coblation-assisted turbinoplasty.

6. Microdebrider-Assisted Inferior Turbinoplasty (MAT)

Turbinate reduction can be achieved very effectively with a mini-microdebrider. The procedure involves creating a submucosal tunnel through a small incision at the anterior end of the turbinate. The erectile tissue can be reduced over the medial and inferior parts of the turbinate by partial resection using a 2mm diameter oscillating mini-microdebrider blade. Post-operative nasal packing is not necessary with this technique. The mini-microdebrider allows for precise control, enabling effective reduction while preserving the overlying mucosa, thus minimizing risk.

6.1. Operative technique

The procedure begins with a stab incision in the head of the inferior turbinate using the tip of the specialized microdebrider blade or a scalpel. The microdebrider blade is then advanced, with the cutting surface facing laterally, to create a submucosal pocket on the inferomedial surface of the turbinate bone, utilizing the flat tip as an elevator. If a specialized turbinate blade is unavailable, flap dissection can be achieved using a Cottle or Freer elevator[48].

Next, the microdebrider blade is rotated toward the submucosal soft tissue and activated, typically at speeds of up to 3,000 rpm in oscillating mode. Care must be taken to avoid flap perforation while targeting the anterior and inferomedial submucosal soft tissue that contributes significantly to nasal airflow obstruction. Submucosal resection can be extended all the way to the tail of the turbinate posteriorly; however, this carries an increased risk of bleeding due to injury to vascular contributions from the posterior lateral nasal and sphenopalatine arteries[24].

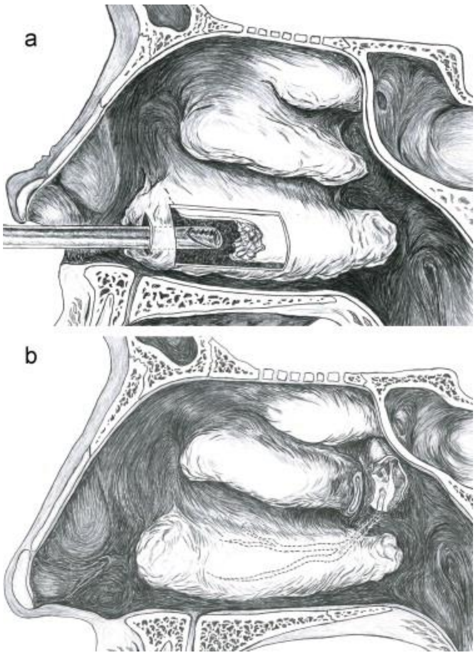


***Figure 6 Microdebrider-Assisted Turbinoplasty from Albu et al. (2014), has been included with the necessary permissions for reference**[50]*

Submucosal microdebrider reduction has also been combined with a procedure to divide the posterior nasal nerve at the sphenopalatine foramen. This combined procedure is known as functional inferior turbinosurgery (FITS). The aim of FITS is to interfere with the autonomic control of the turbinates and reduce their sensation, further improving nasal airflow and patient comfort[51].

6.2. Surgical Outcomes

Since MAT is a cold technique, it does not cause thermal damage to the mucosa and bone tissue, as seen with hot techniques. This characteristic ensures preservation of tissue integrity and reduces the risk of complications associated with thermal injury. Furthermore, MAT does not lead to the formation of scar tissue, allowing for immediate effects to be observed post-procedure. The preservation of mucosal integrity ensures the maintenance of nasal physiology, including mucociliary activity and the heating and humidification of inhaled air. Consequently, the risk of complications is minimized[52].

A study examining the ultrastructural aspects of the nasal mucosa after inferior turbinate reduction demonstrated that the microdebrider gently removes soft tissue and nasal mucosa without burning the resection margins, facilitating a re-epithelialization process. Preservation of the mucosa in this technique reduces the occurrence of side effects such as bleeding, crust formation, post-operative pain, foul odor, synechia, or atrophic changes, which are rare. The most common complication associated with MAT is mucosal tears, predominantly occurring in the medial part. However, since there is no loss of mucosa and no treatment is required, this complication is typically minor and self-limiting[52].

MAT has been shown in various studies to cause a greater decrease in inferior turbinate volume compared to other methods[53–55]. Although this procedure is generally referred to as "turbinoplasty," some surgeons prefer a partial turbinectomy, which includes the resection of the overlying mucosa of the turbinate tissue as part of the procedure. This approach can vary depending on the specific surgical goals and the surgeon's preference.

7. Coblation Inferior Turbinate Reduction (CAT)

Coblation is a distinctive method for delivering radio frequency energy to soft tissue, commonly used in otolaryngology. This technique employs radio frequency in a bipolar mode along with a conductive solution, such as saline, which energizes the ions in the saline to create a small plasma field. This results in a reduced thermal effect, leading to less pain and faster recovery when tissue is excised. Coblation works by vaporizing and destroying the soft erectile tissue of the inferior turbinate, leading to immediate and sustainable volume reduction and tissue fibrosis. This process prevents further swelling and hypertrophy of the inferior turbinate by causing contracture and anchoring of the mucosa to the periosteum due to fibrosis. Coblation can be performed using either an intraturbinoplasty or extraturbinoplasty technique[56].

7.1. Operative technique

Nasal turbinate reduction surgery using a modified coblation and outfracture technique begins with the injection of 1% lidocaine and epinephrine into the inferior turbinate. Coblation is then performed using an ArthroCare ENT ReFlex Ultra Wand (ArthorCare Corp., Sunnyvale, Calif.). The instrument is placed submucosally into the anterior aspect of the inferior turbinate. With an ablation setting of six and a coagulation setting of four, a submucosal lesion is created by guiding the wand as far posteriorly as possible without damaging the adjacent nasal septum. This precaution is necessary to reduce the incidence of postoperative nasal synechiae between the nasal septum and inferior turbinate. An Afrin-soaked pledget is inserted into the nasal airway to control bleeding, and the contralateral turbinate is treated similarly. This initial portion of the procedure effectively reduces the submucosal tissue of the anterior and middle portions of the inferior nasal turbinate[56].

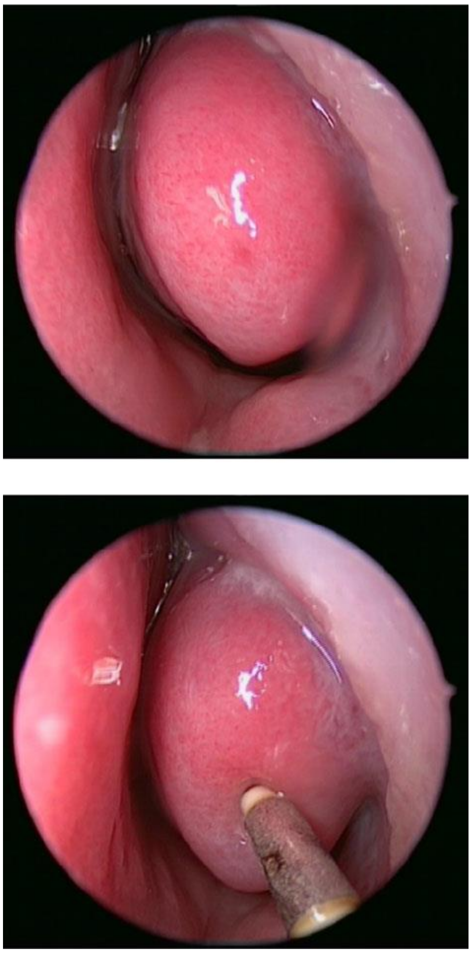


Figure 7 Coblation Inferior Turbinate Reduction (CAT)

Subsequent outfracture of the turbinate not only reduces nasal airway resistance but also allows greater visualization and access to the posterior aspect of the turbinate.

Outfracture is accomplished using a blunt elevator to fracture the conchal bone in the midportion. To achieve adequate reduction of the posterior inferior turbinate, a second lesion is created using the coblator wand, either submucosally or transmucosally, on the posterior aspect of the inferior turbinate. Again, careful attention is paid to avoid injury to the nasal septum. No packing is placed in the nasal cavity postoperatively. Afrin is used twice daily for one week to help control epistaxis and decrease edema in the immediate postoperative period. Over several weeks, the nasal turbinate heals, resulting in a significantly improved inferior nasal airway[57].

7.2. Changes in nasal physiology after turbinoplasty

The thickening of the medial section of the turbinate's mucosa and the widening of the lamina propria have both contributed to the overall enlargement of the turbinate. Additionally, the venous sinusoids within the hypertrophied turbinate have become engorged, whereas the arteries, submucosal glands, and connective tissue remain largely unaffected[58]. Following surgical intervention, preserving the integrity of the mucosal surface epithelium is essential to ensure proper mucociliary clearance. Any procedure aimed at reducing turbinate size should strive to maintain or enhance mucosal morphology to preserve nasal function[59].

While no single approach is universally accepted for treating turbinate hypertrophy, microdebrider turbinoplasty is recognized as one of the most effective and safest techniques[60]. Ultrasound turbinoplasty has also been explored as a method for turbinate reduction, though there is limited evidence supporting its efficacy in significantly decreasing turbinate size[61]. Both microdebrider turbinoplasty and radiofrequency turbinoplasty have their respective benefits and drawbacks, but the former remains the more commonly utilized procedure[62].

Several additional factors must be considered when evaluating surgical outcomes[63]. Turbinate hypertrophy may result from mucosal, osseous, or a combination of both types of enlargement, making thorough preoperative assessment crucial in selecting the most appropriate technique to address the specific causes of nasal obstruction[64].

7.3 Surgical Outcomes

Coblation surgery improves nasal breathing by reducing the volume of the inferior turbinate using low-heat radiofrequency energy. This submucosal technique decreases soft tissue bulk, leading to significant submucosal fibrosis, glandular, and venous sinusoid depletion, as reported by Berger et al. Magnetic resonance imaging has shown an average 8.7% reduction in turbinate volume following surgery[65]. Despite concerns that this could negatively affect the subjective sensation of nasal patency due to potential damage to sensory nerves from fibrosis, these histological changes are not unique to Coblation surgery and are seen in other surgical techniques on the inferior turbinate[66]. Such changes might damage cold receptors in the nasal mucosa, diminishing postoperative airflow sensation, though this hypothesis remains unproven. Interestingly, similar histological alterations are already present in pre-operative chronic rhinitis patients, including epithelial degeneration, loss of cilia, intercellular disruption, edema, increased secretory activity, and inflammatory infiltration. Nevertheless, surgery generally improves the subjective perception of nasal airflow, suggesting that the benefits of increased airflow outweigh any potential decrease in sensory nerve function[66–68].

8. MAT vs CAT

While both procedures target the inferior turbinate, they differ in their mechanisms of action and surgical approaches. Understanding the comparative effectiveness of MAT and CAT is essential for clinicians and patients in making informed decisions regarding treatment options. This section aims to provide a comprehensive comparison of MAT and CAT based on various clinical studies, evaluating their outcomes, complication profiles, and patient satisfaction. By examining the collective evidence, we aim to elucidate the strengths and limitations of each technique and guide clinicians in selecting the most appropriate approach for individual patients.

In the comparative study conducted by Lee et al.(2009)[69], at 12 months postoperative, the VAS score for nasal obstruction was significantly lower in the CAT group (3.60 ± 0.50) compared to the MAT group (2.70 ± 0.47). There were no significant differences in VAS scores between the two groups at 3 and 6 months postoperative.

Regarding operation time, CAT took an average of 4.5 ± 0.14 minutes, while MAT took 4.9 ± 1.10 minutes. Crust formation duration was similar between groups, but postoperative bleeding was higher in MAT (26%) compared to CAT (6.6%). Postnasal drip occurrence was slightly higher in MAT (10%) versus CAT (6.6%).

Acoustic rhinometry showed significant improvements in both groups. CAT increased the cross-sectional area from 0.59 ± 0.13 cm^2 to 0.62 ± 0.11 cm^2 and nasal cavity volume from 5.48 ± 0.25 cm^3 to 6.31 ± 0.17 cm^3. MAIT showed greater improvements, with the cross-sectional area increasing from 0.61 ± 0.16 cm^2 to 0.70 ± 0.19 cm^2 and volume from 5.55 ± 0.25 cm^3 to 6.75 ± 0.39 cm^3, indicating superior results in MAT.

In the comparative study by Hegazi et. al.(2013-14)[70] between CAT and MAT, several key findings emerged. Objectively, there was no significant difference in the preoperative and postoperative turbinate scores between the two groups ($p = 0.786$), and the duration of surgery was similar. Subjectively, the Coblation group experienced significantly less postoperative pain during the first 48 hours, with an average score of 4 compared to 6 in the MAT group ($p = 0.0001$). No other significant differences were noted in nasal discharge, obstruction, sneezing and itching, crust formation, dryness, or patient satisfaction.

Regarding complications, postoperative bleeding was less frequent in the Coblation group (10%) compared to the MAT group (26.7%), but this was not statistically significant ($p = 0.67$). No patients in the Coblation group required nasal packing, while two in the MAT group did. Adhesions between the inferior turbinate and the septum were more common in the MAT group (16.7%) than in the Coblation group (5%), but this difference was not statistically significant (p = 0.130).

In comparing CAT and MAT as studied by Singh et al.(2020)[71], several observations were made. Both techniques effectively reduced turbinate size, edema, and secretions, with no crusting or synechiae observed during follow-up visits. Symptom improvement and endoscopic evaluations showed no significant differences between the two groups, indicating that both methods are equally effective.

Regarding intraoperative and postoperative complications, the duration of surgery was significantly longer for the CAT group, averaging 20.67 minutes compared to 17.15 minutes for the MAT group (p = 0.001). However, there was no significant difference in intraoperative bleeding (p = 0.365), with neither group experiencing uncontrolled bleeding or requiring nasal packing. Postoperative pain scores were tolerable for both techniques, with VAS pain scores below 5 at 6 hours post-operatively. By day 7, the average pain scores were 2.65 for MAT and 2.19 for CAT, both considered mild. Thus, despite the longer operative time for CAT, there were no significant differences in intraoperative bleeding or postoperative pain between the two groups.

In study conducted by Jadhav et. al.(2022)[72], comparing Microdebrider-Assisted Inferior Turbinoplasty (MAT) and Coblation-Assisted Inferior Turbinoplasty (CAT), the postoperative outcomes were evaluated. The mean pre-operative NOSE score in the MAT group was 74, while in the CAT group, it was 78. Postoperatively, both techniques showed improvement in the NOSE score at different follow-up intervals. However, on comparison between the two techniques, CAT provided better improvement in NOSE scores on each follow-up day, and the results were highly significant ($p < 0.01$).

Nasal endoscopy was employed to assess the percentage thickness of the inferior turbinate at the internal nasal valve area pre- and post-operatively. The preoperative mean inferior turbinate size (%) in group A (MAT) was 90.46% (right nostril) and 86.46% (left nostril), while in group B (CAT), it was 78.66% (right nostril) and 76.34% (left nostril). Comparing pre-operative and post-operative (day 60) inferior turbinate size, significant reductions were observed in both techniques in both nostrils. The mean day 60 inferior turbinate size was 42.22% (right) and 40.45% (left) for MAT, and 56.22% (right) and 50.26% (left) for CAT. Paired t-tests revealed statistically significant results ($p < 0.01$) for both techniques in both nostrils. Unpaired t-tests, comparing the percentage size of the inferior turbinate between the two techniques on each follow-up day, indicated comparable results ($p > 0.05$) on post-operative day 7. However, in subsequent follow-ups, MAT demonstrated a superior reduction in inferior turbinate size compared to CAT, with highly significant results ($p < 0.01$) on each follow-up day.

The mean Muco-ciliary Transit Time (MTT) in pre-operative and post-operative (day 60) cases was assessed using Saccharin Test. MAIT exhibited MTT values of 12.25 minutes pre-operatively and 13.35 minutes post-operatively, while CAT showed MTT values of 12.57 minutes and 13 minutes, respectively. The paired t-test revealed a significant increase in MTT for the microdebrider group ($p < 0.05$), whereas there was no significant change observed in the coblator group. Post-operative evaluation also included assessments for complications such as nasal bleeding, crusting, and synechiae formation. Minimal bleeding was observed in both groups post-operatively, with no significant difference between them. However, a higher incidence of nasal crusting was noted in the micro-debrider group, with 75 out of 80 patients experiencing crusting compared to 70 out of 80 patients in the coblator group by day 7. Nevertheless, both techniques showed a significant reduction in the number of cases with nasal crusting over further follow-up days, with most cases free of crusting by day 60. Regarding synechiae formation, the microdebrider group exhibited a higher incidence on post-operative day 7 (34.35%) compared to the coblator group (24.22%). However, negligible cases showed synechiae on subsequent follow-up days, with no evidence of synechiae by day 60 in both techniques.

In a comparative study by Bhagat et al.(2024)[73], MAT and CAT were evaluated for their effectiveness in treating nasal obstruction. The findings indicated that endoscopic grading showed greater improvement in patients who underwent MAT compared to those who had CAT. However, when post-operative SNOT-22 scores were analyzed, the best symptom improvement at the end of three months was observed in patients who underwent CAT, followed by those who had MAT and Submucous Diathermy. Despite these differences, statistical analysis using the one-way ANOVA test revealed no significant difference in SNOT-22 scores postoperatively between the three surgical methods at one week, one month, and three months. This suggests that the overall improvement in symptoms was similar across all methods[73].

Interestingly, there was a significant difference in average postoperative Visual Analog Scale (VAS) scores between the techniques. Specifically, at one week post-surgery, the average VAS score was 4.86 for CAT and 5.6 for MAT, indicating that patients who underwent CAT experienced less pain initially. Over the subsequent months, the differences in VAS scores between the two techniques were not significant[73]. Post-operative crusting, a common complication, was found to decrease over time with follow-up visits. The highest incidence of crusting was observed in patients who underwent MAT compared to those who had CAT. This study highlights that while both surgical techniques are effective, they have different profiles in terms of post-operative recovery and complications[73].

Each study investigated various aspects of Microdebrider-Assisted Inferior Turbinoplasty (MAT) and Coblation-Assisted Inferior Turbinoplasty (CAT) to evaluate their efficacy in treating nasal obstruction and associated symptoms. Lee et.

al.(2009)[69] primarily focused on postoperative outcomes, highlighting a significant improvement favoring CAT over MAT in VAS scores for nasal obstruction at 12 months. Hegazi et. al.(2013-14)[70] examined both objective and subjective measures, finding no significant differences in preoperative and postoperative turbinate scores between CAT and MAT. Singh et. al.(2020)[71] evaluated turbinate size, edema, and secretions, concluding that both techniques were equally effective based on symptom improvement and endoscopic evaluations. Jadhav et. al.(2022)[72] assessed postoperative outcomes and nasal endoscopic findings, noting better improvement in NOSE scores with CAT and significant reductions in inferior turbinate size with both techniques, with MAT showing superior reduction.

In comparison, Bhagat et. al.(2024)[73] evaluated the effectiveness of MAT and CAT in treating nasal obstruction, finding greater improvement in endoscopic grading with MAT and better symptom improvement at three months post-surgery with CAT. However, statistical analysis revealed no significant difference in symptom scores postoperatively between the two techniques. Notably, CAT patients experienced less initial postoperative pain, and both techniques showed a decrease in post-operative crusting over time, albeit with a higher incidence in MAT.

Overall, while differences exist in specific findings across studies, the collective evidence suggests that both MAT and CAT are effective in improving nasal obstruction symptoms. However, they may vary in terms of specific outcomes and complication profiles, indicating the importance of individual patient factors and preferences in selecting the most suitable surgical approach.

MATERIALS AND METHODS

Study Setting

The Study Was Conducted in the Department of Otorhinolaryngology at Shri B M Patil Medical College and Research Centre Vijayapura, Karnataka.

Study Design

This study was designed as a hospital-based observational study.

Study Duration

The study was conducted from April 2023 to January 2025

Study Population

The study population consisted of patients admitted for either microdebrider-assisted or coblation-assisted turbinoplasty surgery.

Inclusion Criteria

1. Minimum duration of three months of nasal obstruction with clinical findings of inferior turbinate hypertrophy.
2. Patients with underlying conditions, such as

- Seasonal allergies
- Mild to moderate DNS

Exclusion Criteria

- Previous history of turbinate surgery
- Septal perforation or deformity
- Bleeding disorders

- Craniofacial malformations or congenital malformations
- Patients with morbid obesity
- Maxillofacial trauma
- Tumors
- Granulomatous diseases of the nose
- Gross deviated nasal septum (DNS)
- Chronic Rhinosinusitis

Sample Size

The anticipated Mean ± SD of Operation time in Coblation and Microdebrider groups is 4.5 ± 0.14 and 4.9 ± 1.10. The required minimum sample size is 30 per group (i.e., a total sample size of 60, assuming equal group sizes) to achieve a power of 80% and a level of significance of 5% (two-sided) for detecting a true difference in means between two groups.

$$N = 2\left[\frac{(Z_{\propto} + z_{\beta}) * S}{d}\right]^2$$

Zα - Level of significance=95%

Zβ - power of the study=80%

d = clinically significant difference between two parameters

S = Common standard deviation

Sampling Technique

Consecutive sampling

Study Procedure

The attending surgeon admits the patient with the plan for either microdebrider-assisted or coblation-assisted turbinoplasty

↓

OPD based or pre-operative assessment
(Symptoms and endoscopic findings)

↓

Intra-operative assessment

↓

Post-operative assessment at 6 hours
(Symptoms and endoscopic findings)

↓

Follow-up assessment on 7th-day post-op
(Symptoms and endoscopic findings)

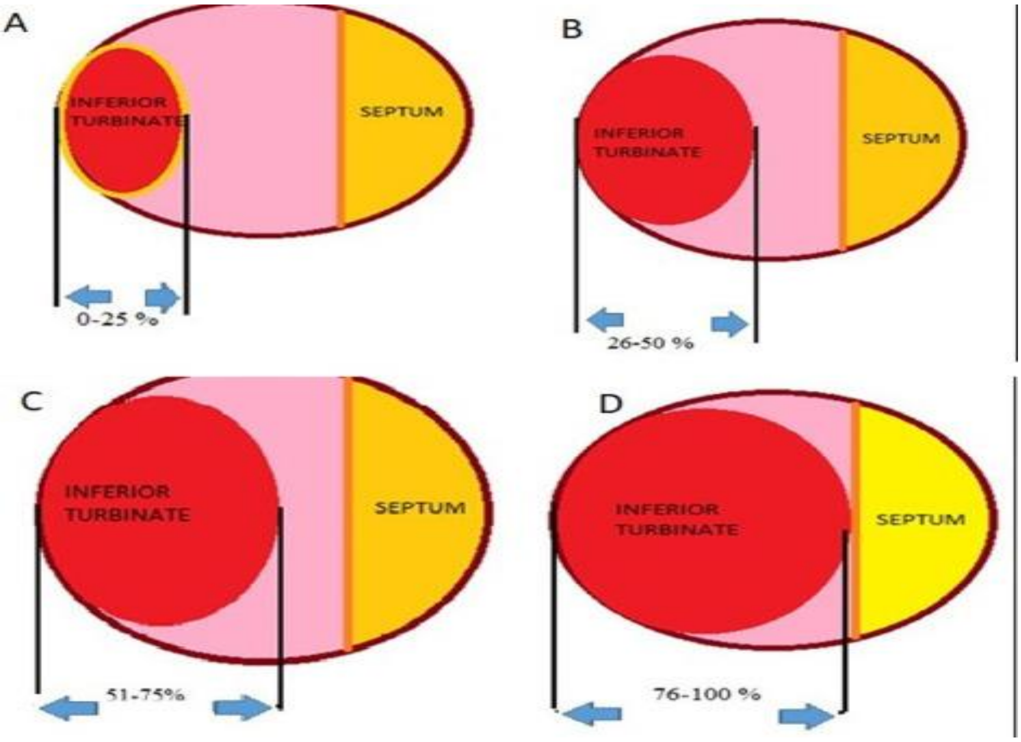
↓

Follow-up assessment at 2nd month post-op
(Symptoms and endoscopic findings)

↓

Follow-up assessment at 3rd-month post-op
(Symptoms and endoscopic findings)

Figure 8 :Pre- and post operative endoscopic assessment of turbinate size done using Camacho et al. classification .From Sharanjeet Singh et al. (2020) has been included with necessary permission from the article.



Pre- and post operative symptomatic assessment done using NOSE score.

	0 (No symptom)	1	2	3	4	5	6	7	8	9	10 (Most Severe)
Nasal Obstruction											
Sneezing											
Rhinorrhea											
Hyposmia											
Headache											
Snoring											
Dry mouth upon waking/ sleeping with mouth open											

Statistical Analysis

The collected data were initially entered into Microsoft Excel 2010 for organization and cleaning. After ensuring accuracy and completeness, the dataset was imported into Jamovi Solid Version 2.3.28 for statistical analysis. The normality of continuous variables such as age, BMI, and vital parameters was assessed using Q-Q plots. Descriptive statistics were used to summarize the data, with continuous variables expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on their distribution. Categorical variables, including gender, weight groups, and visual function parameters, were presented as frequencies and percentages.

For inferential analysis, appropriate statistical tests were chosen based on the type and distribution of data. The normality of continuous variables such as intraoperative blood loss, surgical duration, and postoperative symptom scores was assessed using the Shapiro-Wilk test and visual inspection of Q-Q plots. Normally distributed variables were compared between groups using the independent t-test, with effect sizes calculated using Cohen’s d to quantify the magnitude of differences. Non-normally distributed continuous variables, including pain scores and nasal obstruction severity, were analyzed using the Mann-Whitney U test, with results expressed as median and interquartile range. Categorical variables, such as gender distribution, presence of synechiae, and postoperative bleeding, were assessed using the chi-square test or Fisher’s exact test when expected cell counts were less than five. The homogeneity of variances was tested using Levene’s test, ensuring the appropriate selection of parametric or non-parametric tests. Additionally, the chi-square test for trend was employed where applicable to assess the relationship between ordinal variables.

All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

Ethical Consideration

Approval was obtained from the Institutional Ethics Committee before commencing the study. Written informed consent was secured from all participants prior to their inclusion. The investigator provided each eligible subject with a detailed explanation of the study's purpose, ensuring they understood the procedures involved. Participants were assured of the confidentiality of their information and their right to withdraw from the study at any time.

The study was designed to pose no risk to the participants, their families, or the investigator.

Surgical Procedure

All patients underwent surgery under general anesthesia. The patient was positioned in the reverse Trendelenburg position with 15–20 degrees of head-end elevation to facilitate venous drainage while ensuring adequate cerebral perfusion. The surgical site was painted and draped under sterile precautions.

Coblation-Assisted Turbinoplasty

Coblation-assisted turbinoplasty was performed by first achieving topical decongestion using 4% lignocaine with adrenaline applied to the inferior turbinates for 10 minutes. This was followed by local infiltration with 2% lignocaine with adrenaline and saline to both inferior turbinates for additional anesthesia and vasoconstriction.

The coblator wand was introduced into the hypertrophied turbinate up to the third black marking and activated for 10 seconds to achieve controlled tissue ablation. The wand was then withdrawn progressively, with ablation performed at each black marking along the length of the turbinate for 10 seconds each. The turbinate was subsequently out-fractured and lateralized to further improve nasal airway patency.

Postoperative nasal packing was not required, as intraoperative bleeding was minimal.

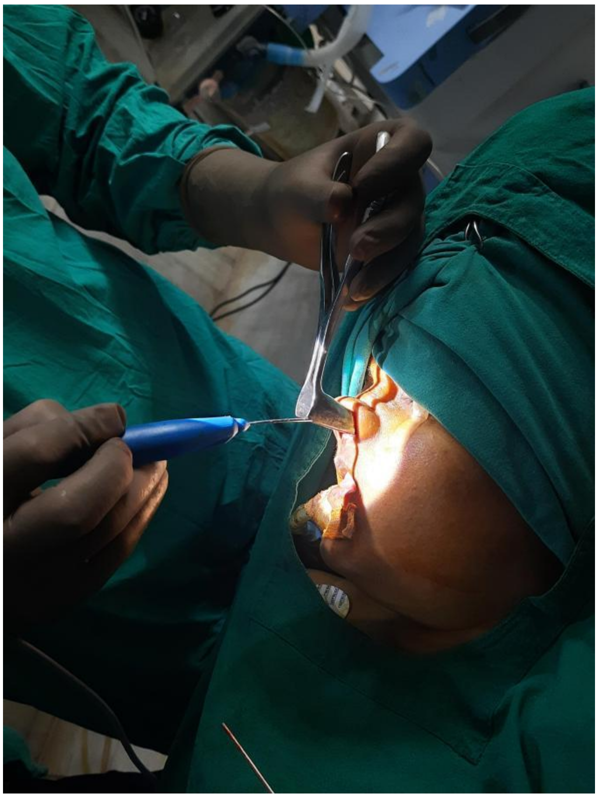


Figure 9: Procedure of coblator assisted turbinoplasty

Figure10 : Arthrocare Reflux Ultra PTR &45 Coblator wand

Figure 11 : Radio frequency generator with irrigation controller, along with foot pedal for coagulation and ablation

Microdebrider-Assisted Turbinoplasty

Microdebrider-assisted turbinoplasty was performed using the same preparation steps, including topical decongestion with 4% lignocaine with adrenaline for 10 minutes and local infiltration with 2% lignocaine with adrenaline and saline to both inferior turbinates. A microdebrider wand was introduced into the anterior end of the hypertrophied inferior turbinate and advanced posteriorly. Submucosal debridement was performed along the entire length of the turbinate while ensuring mucosal preservation. The turbinate was then out-fractured and lateralized, and the same procedure was repeated on the opposite side.

Postoperatively, nasal packing was not required due to minimal blood loss. In cases where mild bleeding was anticipated, angel foam was applied to promote hemostasis. Both surgical techniques were performed with the objective of maximizing nasal airway improvement while minimizing mucosal trauma, ensuring optimal postoperative recovery and symptom relief.

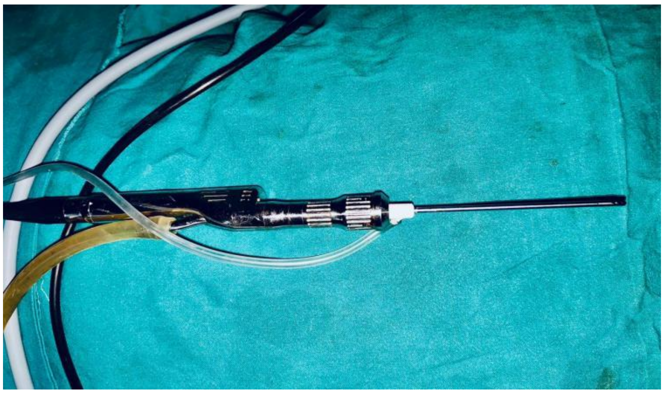


Figure 12: Medtronics microdebrider blade with irrigation port

Figure 13 : Medtronics M4 microdebrider with foot pedal

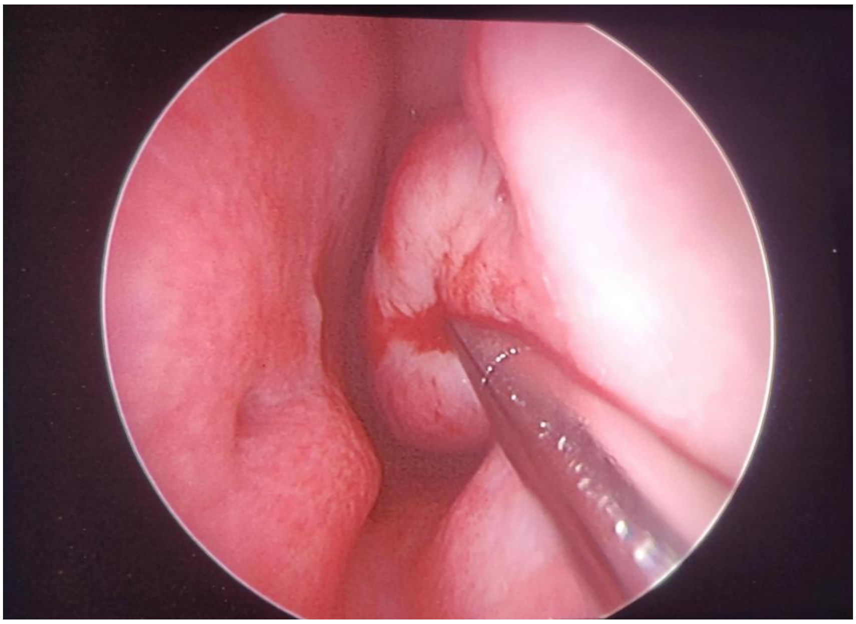


Figure 14: Procedure of performing microdebrider assisted turbinoplasty

OBSERVATIONS AND RESULTS

Figure 15 :Age distribution of participants (N=60)

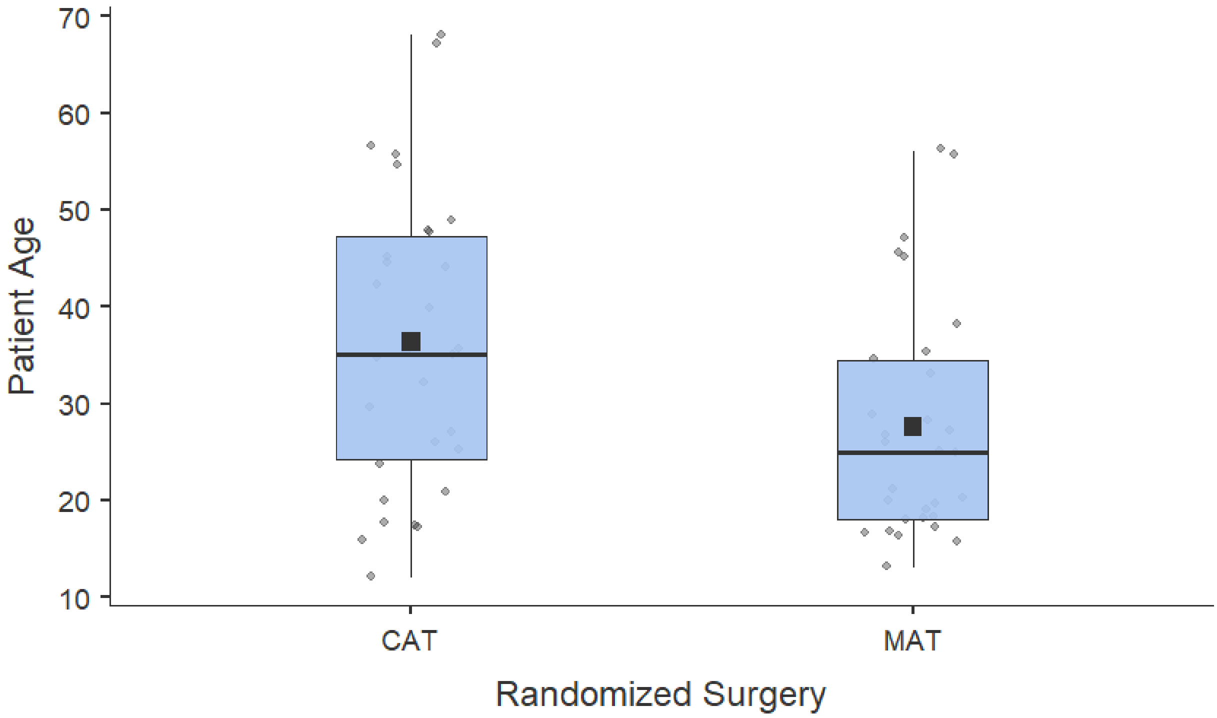


Table 1 Age distribution of participants (N=60)

Surgery	**Mean ± SD**	**Minimum**	**Maximum**	**t statistic (df), P-value**
MAT	27.6 ± 12	13	56	2.43 (58), 0.283
CAT	36.3 ± 15.5	12	68	

in years

The age distribution of participants is summarized in Figure 15 and Table 1. The Microdebrider-Assisted Turbinoplasty (MAT) group had a mean age of 27.6 ± 12 years, with a minimum age of 13 years and a maximum of 56 years. In contrast, the Coblation-Assisted Turbinoplasty (CAT) group had a higher mean age of 36.3 ± 15.5 years, ranging from 12 to 68 years.

Statistical analysis using an independent t-test revealed no significant difference between the two groups ($t = 2.43$, $df = 58$, $p = 0.283$). This suggests that age was evenly distributed between the groups, supporting the validity of the randomization process. Hence, the comparison of outcomes between the MAT and CAT groups is unlikely to be influenced by age-related confounding.

Figure 16:Gender distribution across both surgery (N=60)

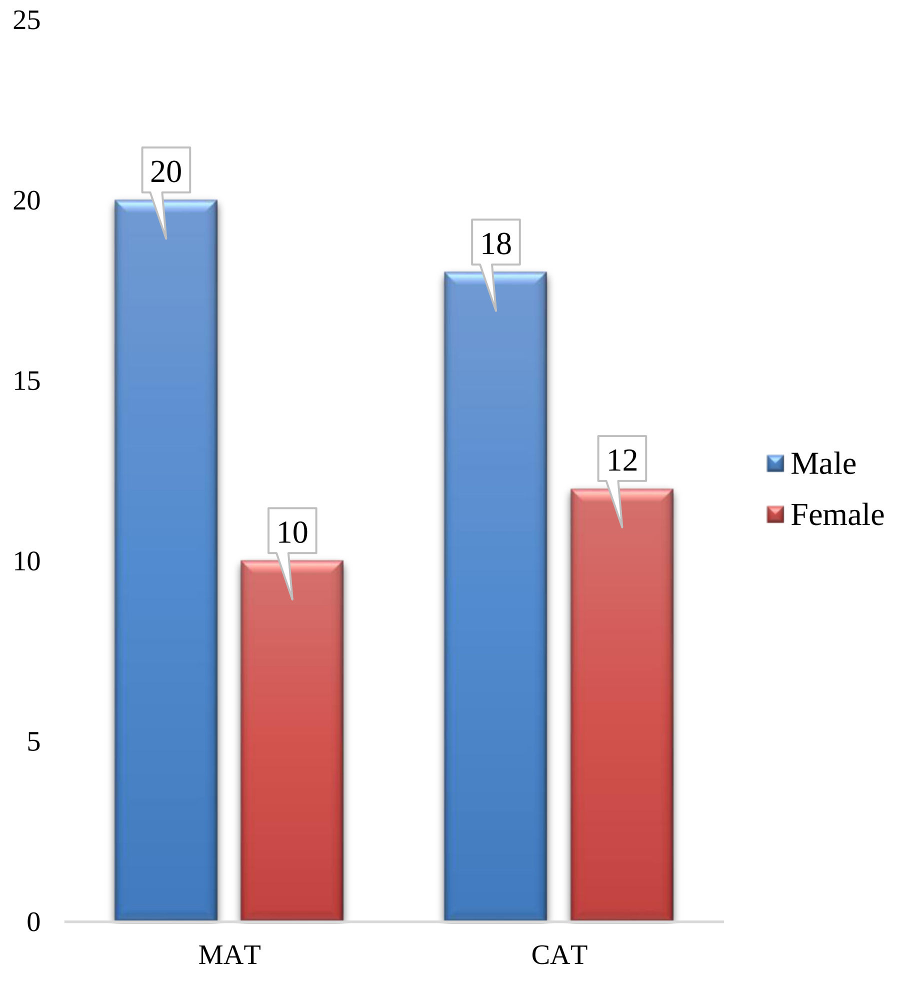


Table 2 Gender distribution across both surgery (N=60)

Surgery	Gender		χ^2 (df), P-value
	Male	Female	
MAT	20	10	0.28 (1), 0.592
CAT	18	12	

The study included a total of 60 participants, with a comparable distribution of males and females across both surgical groups. In the Microdebrider-Assisted Turbinoplasty (MAT) group, **20 (66.7%)** were male and **10 (33.3%)** were female. Similarly, in the Coblation-Assisted Turbinoplasty (CAT) group, **18 (60%)** were male and **12 (40%)** were female. A chi-square test for independence showed no statistically significant difference in gender distribution between the two groups (χ^2 = 0.28, df = 1, p = 0.592), indicating that gender was evenly distributed. This supports the validity of randomization and ensures that gender-related factors are unlikely to influence the study outcomes(Figure 16,Table 2).

Table 3 Pre-operative symptom scores (N=60)

Symptoms	Mean ± SD	Minimum	Maximum
Nasal Obstruction	8.3 ± 1.2	6	10
Sneezing	0.5 ± 1	0	4
Rhinorrhoea	0.35 ± 1	0	3
Hyposmia	0.25 ± 0.7	0	4
Headache	2.5 ± 2.5	0	9
Snoring	1.6 ± 2	0	7
Dry mouth upon waking/ sleeping with mouth open	1.5 ± 1.7	0	7

The severity of pre-operative symptoms was assessed using a patient-reported rating scale from 1 to 10, with nasal obstruction being the most prominent symptom, having a mean score of 8.3 ± 1.2, ranging from 6 to 10. Headache was the second most reported symptom, with a mean score of 2.5 ± 2.5, ranging from 0 to 9. Other symptoms such as sneezing (0.5 ± 1, range: 0–4), rhinorrhoea (0.35 ± 1, range: 0–3), and hyposmia (0.25 ± 0.7, range: 0–4) were reported less frequently and with lower severity. Snoring (1.6 ± 2, range: 0–7) and dry mouth upon waking or sleeping with the mouth open (1.5 ± 1.7, range: 0–7) were also observed in some patients, though with considerable variability in intensity.

The high severity of nasal obstruction highlights its significant impact on the study population, making it the primary complaint among participants. In contrast, other symptoms were present in a smaller proportion of patients and varied in intensity. The presence of symptoms like snoring and dry mouth suggests associated airway compromise, though to a lesser extent than nasal obstruction. The variability in reported scores across symptoms indicates a heterogeneous symptom burden among participants. These baseline scores provide a crucial reference for assessing postoperative symptom improvement and the effectiveness of surgical intervention.

Figure 17:Pre-operative inferior turbinate size grading in nasal endoscopy (N=60)

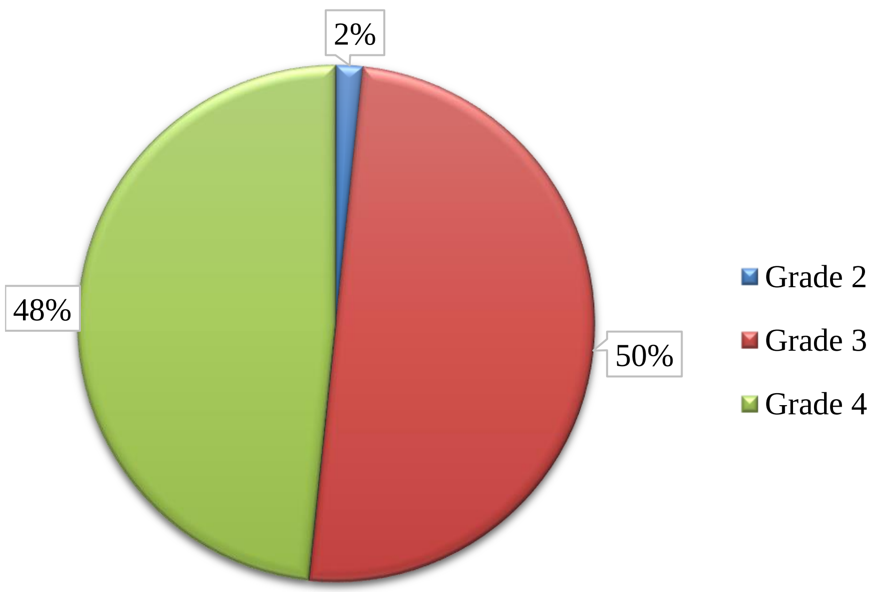


Table 4 Pre-operative inferior turbinate size grading in nasal endoscopy (N=60)

Turbinate size grade	Count (%)
2	1 (1.7%)
3	30 (50%)
4	29 (48.3%)

Nasal endoscopy findings showed that most participants had moderate to severe inferior turbinate hypertrophy, with 30 (50.0%) classified as grade 3 and 29 (48.3%) as grade 4. Only 1 (1.7%) patient had grade 2 turbinate hypertrophy, indicating that the majority of the study population experienced significant nasal obstruction. The near-equal distribution of grade 3 and grade 4 turbinate hypertrophy suggests a substantial disease burden, emphasizing the necessity of surgical intervention for symptom relief. These baseline findings serve as a reference for assessing postoperative outcomes in terms of turbinate size reduction and nasal airflow improvement (Figure 17, Table 4).

Figure 18: Comparison of total intra-operative blood loss (N=60)

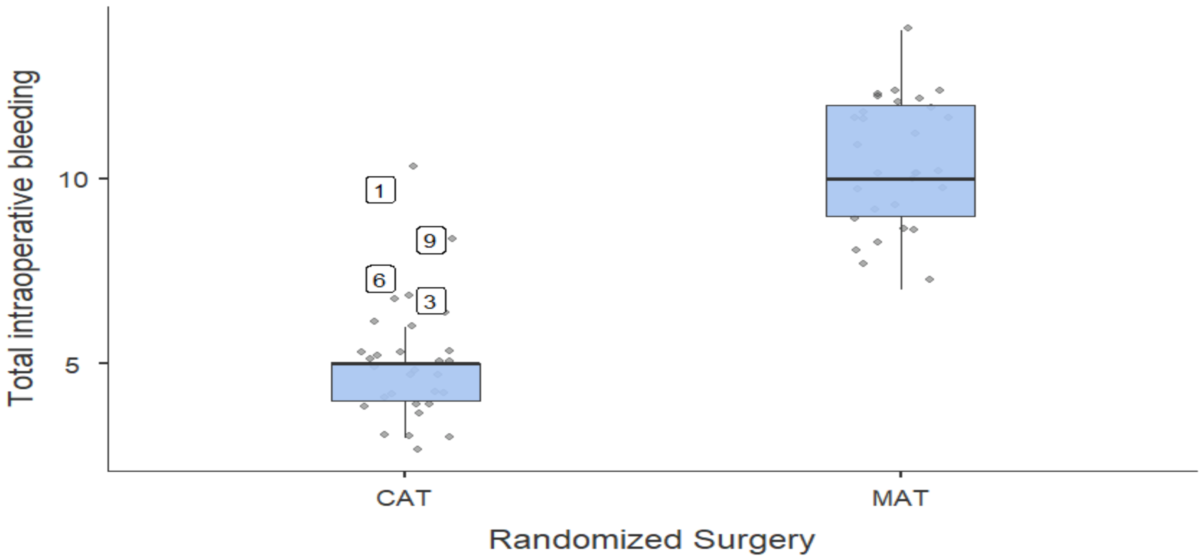


Table 5 Comparison of total intra-operative blood loss (N=60)

Surgery	Intra-operative blood loss in ml (Mean (SD)	t statistic (df), P-value
MAT	10.5 ± 1.7	13.2 (58), < 0.001
CAT	5 ± 1.5	

Cohen's d – 3.76

The comparison of intraoperative blood loss between the two surgical techniques revealed a significant difference. Patients who underwent microdebrider-assisted turbinoplasty (MAT) had a mean blood loss of 10.5 ± 1.7 ml, whereas those in the coblation-assisted turbinoplasty (CAT) group experienced considerably less bleeding, with a mean of 5 ± 1.5 ml. Statistical analysis confirmed that this difference was highly significant ($t = 13.2$, $df = 58$, $p < 0.001$), with a large effect size (Cohen's $d = 3.76$). The substantially lower blood loss in the CAT group suggests that the coblation method offers a superior hemostatic effect compared to the microdebrider technique. This reduction in intraoperative bleeding may contribute to better surgical visibility, reduced operative time, and potentially improved postoperative recovery (Figure 18, Table 5).

Figure 19: Comparison of total time taken across both surgeries (N=60)

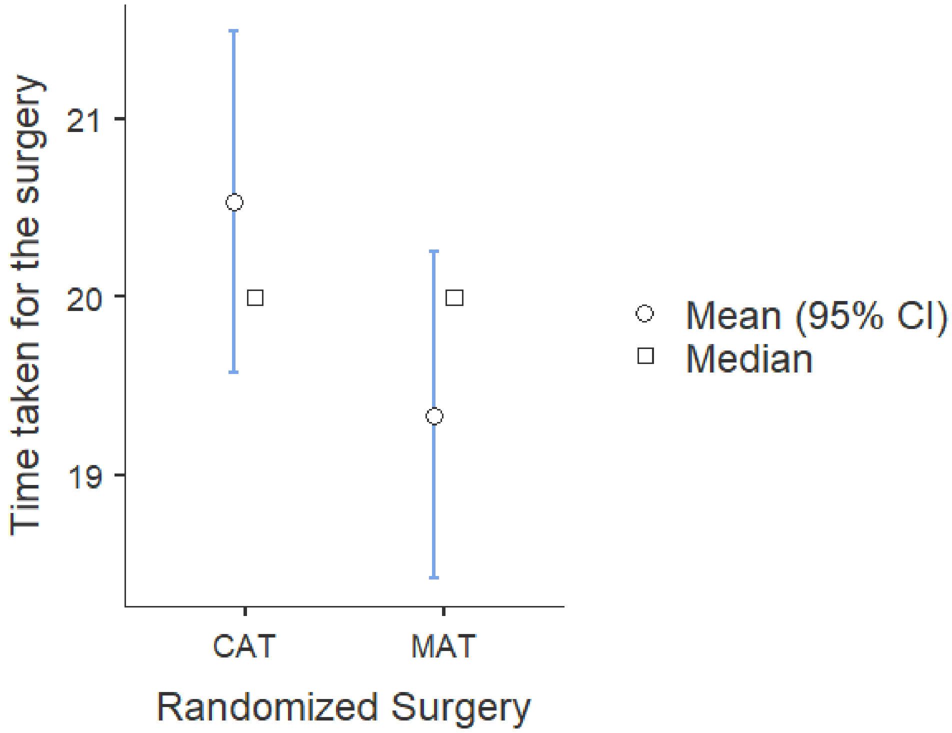


Table 6 Comparison of total time taken across both surgeries (N=60)

Surgery	Total time taken in minutes (Median (IQR)	Mann Whitney statistic, P-value
MAT	20 (18 - 22)	347, 0.124
CAT	20 (20 - 22)	

Figure 19 and Table 6 compare the total duration of surgery between the two groups. The median surgical time for microdebrider-assisted turbinoplasty (MAT) was 20 minutes (IQR: 18–22), while for coblation-assisted turbinoplasty (CAT), it was also 20 minutes (IQR: 20–22). Statistical analysis using the Mann-Whitney test showed no significant difference in surgical duration between the two techniques (U = 347, p = 0.124). These findings suggest that both methods require a similar amount of time for completion, indicating that the choice of technique does not influence the overall surgical duration.

Figure 20:Comparison of 6-hour post-operative pain score across both surgeries (N=60)

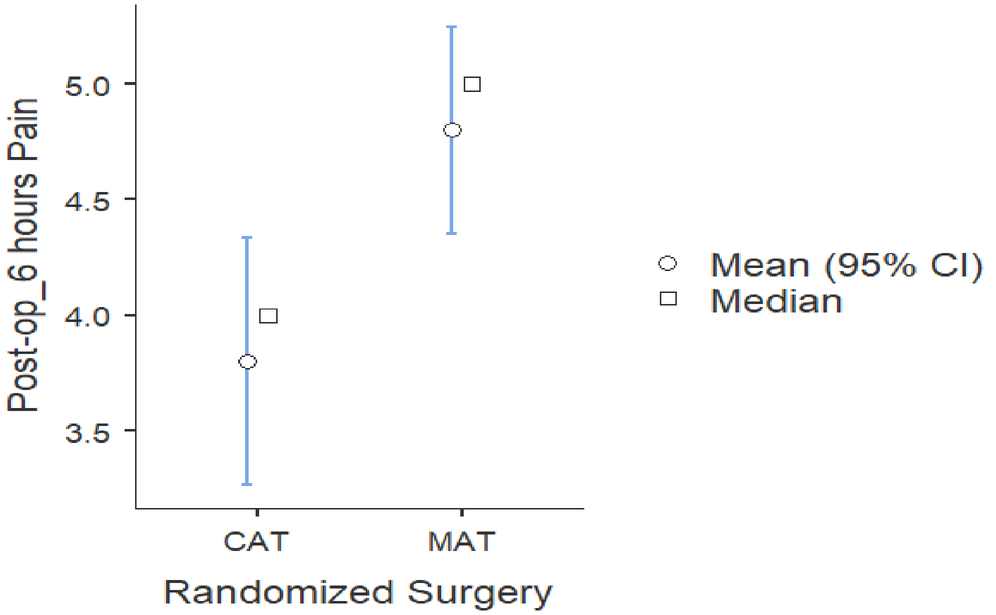


Table 7 Comparison of 6-hour post-operative pain score across both surgeries (N=60)

Surgery	Mean (SD)	t statistic (df), P-value
MAT	5 (1.2)	2.82 (58), 0.007
CAT	4 (1.5)	

Cohen's d – 0.727

Patients who underwent microdebrider-assisted turbinoplasty (MAT) reported higher post-operative pain scores at 6 hours compared to those who underwent coblation-assisted turbinoplasty (CAT). The mean pain score in the MAT group was 5 ± 1.2, while in the CAT group, it was 4 ± 1.5. Statistical analysis showed a significant difference between the groups (t = 2.82, df = 58, p = 0.007), with an effect size of 0.727, indicating a moderate difference in pain levels. These findings suggest that the coblation method may provide better post-operative pain control in the early recovery period (Figure 20, Table 7).

Figure 21:Comparison of 6-hour post-operative bleeding across both surgeries (N=60)

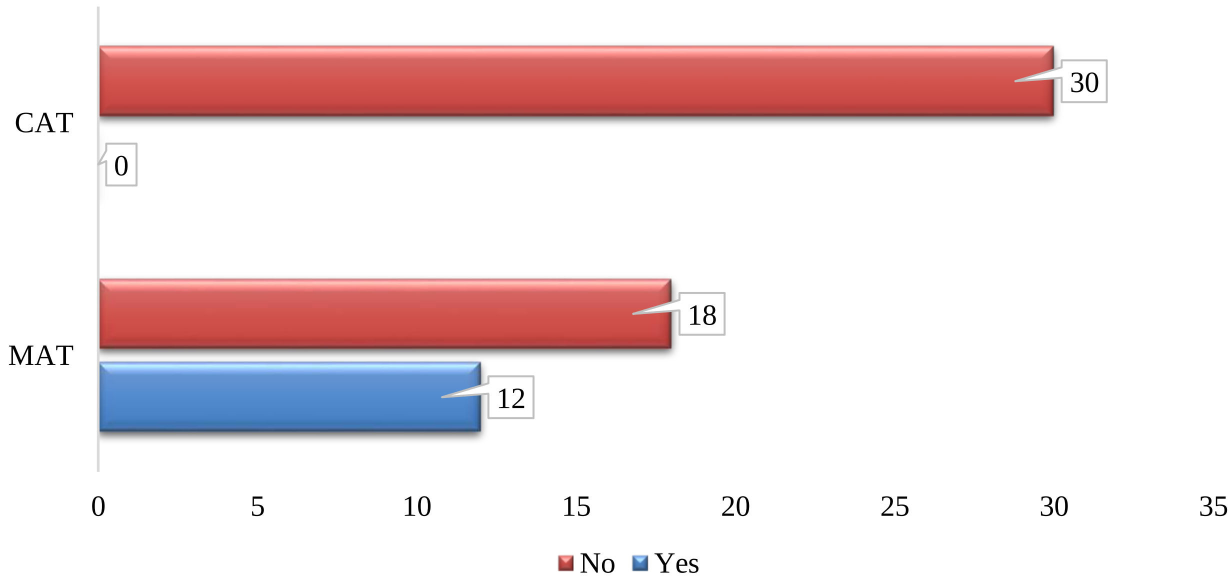


Table 8 Comparison of 6-hour post-operative bleeding across both surgeries (N=60)

Surgery	6-hour post-operative bleeding		Fisher's exact test P-value
	Yes	No	
MAT	12 (40%)	18 (60%)	< 0.001
CAT	0	30 (100%)	

A notable difference was observed between the groups, with 12 patients (40%) in the microdebrider-assisted turbinoplasty (MAT) group experiencing post-operative bleeding, whereas the remaining 18 patients (60%) had no bleeding. In contrast, none of the patients in the coblation-assisted turbinoplasty (CAT) group reported bleeding, with all 30 patients (100%) remaining free of post-operative hemorrhage. Statistical analysis using Fisher's exact test confirmed a highly significant difference between the two techniques ($p < 0.001$). The complete absence of post-operative bleeding in the CAT group underscores the superior hemostatic effect of the coblation method, suggesting a potential advantage in reducing the risk of post-operative complications associated with bleeding (Figure 21, Table 8).

Table 9 7th day post-operative symptom scores (N=60)

Symptoms	Randomized Surgery	Median (IQR)	P-value
Pain	MAT	2 (1 - 2)	< 0.001
	CAT	0 (0 - 1)	
Nasal Obstruction	MAT	4 (4 - 5)	0.173
	CAT	3 (2 – 4)	
Sneezing	MAT	0	-
	CAT	0	
Rhinorrhoea	MAT	0	-
	CAT	0	
Hyposmia	MAT	0	-
	CAT	0	
Headache	MAT	0.5 (0 - 1)	0.873
	CAT	0.5 (0 – 2)	
Snoring	MAT	0	-
	CAT	0	
Dry mouth upon waking/ sleeping with mouth open	MAT	0	-
	CAT	0	

Table 9 presents the comparison of post-operative symptom scores on the 7th day between the two surgical techniques. Pain scores were significantly lower in the coblation-assisted turbinoplasty (CAT) group, with a median score of 0 (IQR: 0–1), compared to 2 (IQR: 1–2) in the microdebrider-assisted turbinoplasty (MAT) group ($p < 0.001$), indicating a clear advantage of the coblation method in reducing post-operative discomfort. Nasal obstruction remained slightly higher in the MAT group, with a median score of 4 (IQR: 4–5), while in the CAT group, it was lower at 3 (IQR: 2–4), though the difference was not statistically significant ($p = 0.173$).

Other symptoms, including sneezing, rhinorrhoea, hyposmia, snoring, and dry mouth upon waking, were absent in both groups, indicating good post-operative recovery. Headache scores were comparable between the two groups, with a median of 0.5 in both, though with a slightly wider range in the CAT group (IQR: 0–2) compared to the MAT group (IQR: 0–1), and the difference was not statistically significant ($p = 0.873$). These findings suggest that while both techniques lead to symptom resolution over time, the coblation method offers a notable advantage in reducing post-operative pain

Figure 22:Comparison of 7th day post-operative nasal endoscopy findings across both surgeries (N=60)

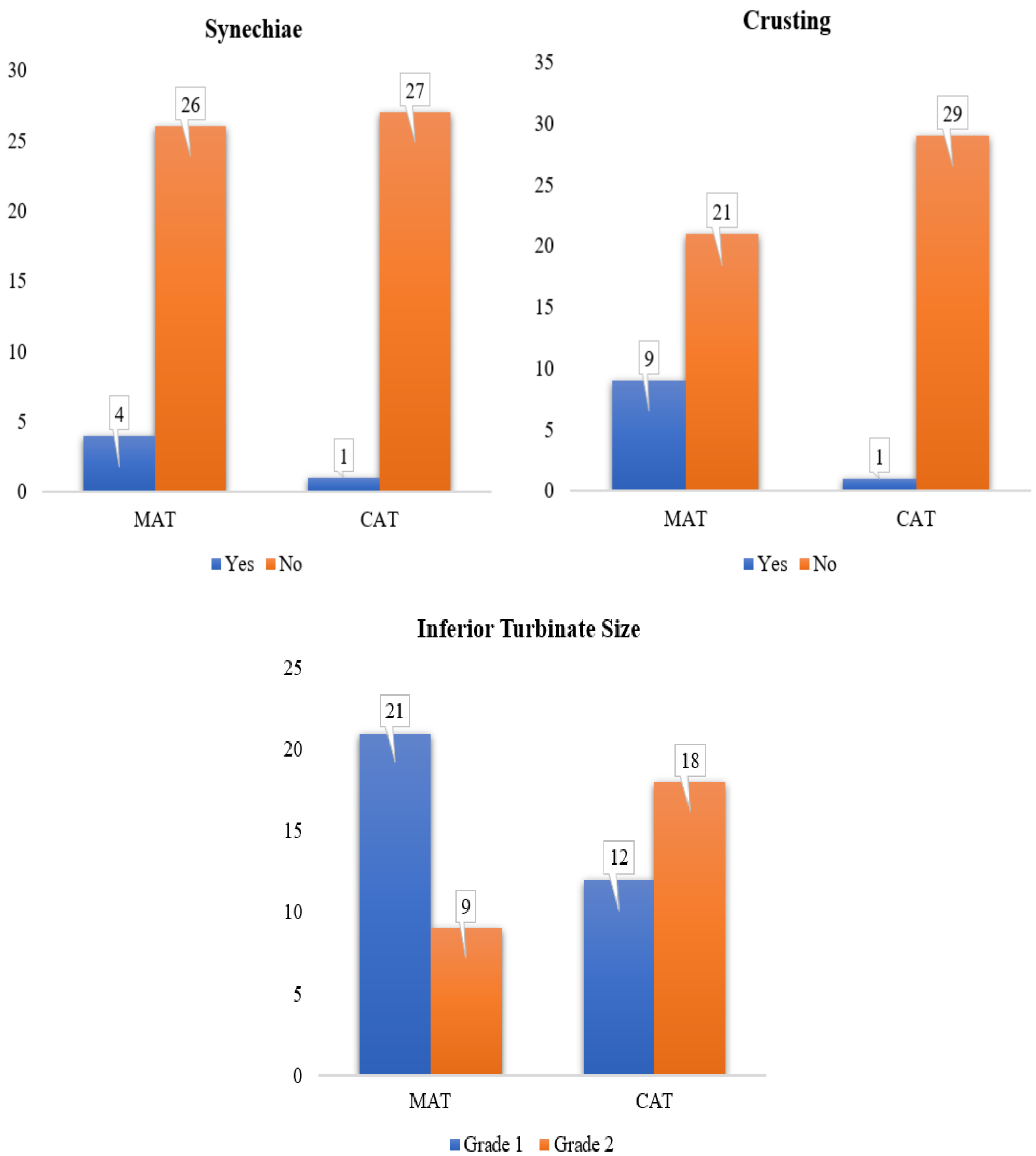


Table 10 Comparison of 7th day post-operative nasal endoscopy findings across both surgeries (N=60)

Signs		Surgery		P-value
		MAT	CAT	
Synechiae	Yes	4 (13.3%)	1 (3.3%)	0.353#
	No	26 (86.7%)	27 (96.7%)	
Crusting	Yes	9 (30%)	1 (3.3%)	< 0.001#
	No	21 (70%)	29 (96.7%)	
Inferior Turbinate Size	Grade 1	21 (70%)	12 (40%)	0.020
	Grade 2	9 (30%)	18 (60%)	

#*Fisher's exact test*

On the 7th post-operative day, nasal endoscopy findings revealed differences in healing outcomes between the two surgical techniques. Synechiae formation was observed in a small number of patients, with 4 cases (13.3%) in the microdebrider-assisted turbinoplasty (MAT) group compared to only 1 case (3.3%) in the coblation-assisted turbinoplasty (CAT) group, though the difference was not statistically significant (p = 0.353). Crusting was more frequent in the MAT group, affecting 9 patients (30%), while it was significantly lower in the CAT group, with only 1 patient (3.3%) experiencing this complication (p < 0.001). These findings suggest that the coblation method may provide a smoother post-operative recovery by reducing excessive crusting.

In terms of inferior turbinate size reduction, a greater proportion of patients in the MAT group achieved grade 1 turbinate size (21 patients, 70%) compared to the CAT group (12 patients, 40%). Conversely, grade 2 turbinate size was more common in the CAT group, affecting 18 patients (60%) compared to 9 patients (30%) in the MAT group. This difference was statistically significant (p = 0.020), indicating that the microdebrider technique was more effective in reducing turbinate size. While both methods showed favorable post-operative outcomes, the microdebrider-assisted technique resulted in better turbinate size reduction, whereas the coblation method minimized post-operative complications such as synechiae and crusting (Figure 22, Table 10).

Table 11 2nd month post-operative symptom scores (N=60)

Symptoms	Randomized Surgery	Median (IQR)	P-value
Pain	MAT	0	-
	CAT	0	
Nasal Obstruction	MAT	2 (1 – 2)	< 0.001
	CAT	0.5 (0 – 1)	
Sneezing	MAT	0	-
	CAT	0	
Rhinorrhoea	MAT	0	-
	CAT	0	
Hyposmia	MAT	0	-
	CAT	0	
Headache	MAT	0	-
	CAT	0	
Snoring	MAT	0	-
	CAT	0	
Dry mouth upon waking/ sleeping with mouth open	MAT	0	-
	CAT	0	

At the 2-month post-operative follow-up, symptom resolution was observed across both surgical groups, with most patients reporting no residual complaints. Compared to the 7th post-operative day, pain had completely subsided in both groups, with a median score of 0. Similarly, symptoms such as sneezing, rhinorrhoea, hyposmia, headache, snoring, and dry mouth upon waking remained absent in all patients, indicating sustained post-operative recovery with minimal long-term complications.

Nasal obstruction showed notable improvement in both groups but remained significantly lower in the coblation-assisted turbinoplasty (CAT) group. At 2 months, the median nasal obstruction score in the microdebrider-assisted turbinoplasty (MAT) group was 2 (IQR: 1–2), while in the CAT group, it was significantly lower at 0.5 (IQR: 0–1) ($p < 0.001$). This reflects a greater and more sustained reduction in nasal obstruction in patients who underwent coblation, in contrast to the MAT group, where some degree of nasal blockage persisted.

When compared to the 7th post-operative day, both techniques showed substantial improvement in symptoms over time. While pain was already minimal by day 7, the significant difference in nasal obstruction at 2 months suggests that coblation may provide superior long-term relief from nasal congestion. Overall, both procedures demonstrated effective symptom resolution, though coblation-assisted turbinoplasty appeared to offer a more pronounced reduction in nasal obstruction by the end of the follow-up period (Table 11).

Figure 23:Comparison of 2nd month post-operative nasal endoscopy findings across both surgeries (N=60)

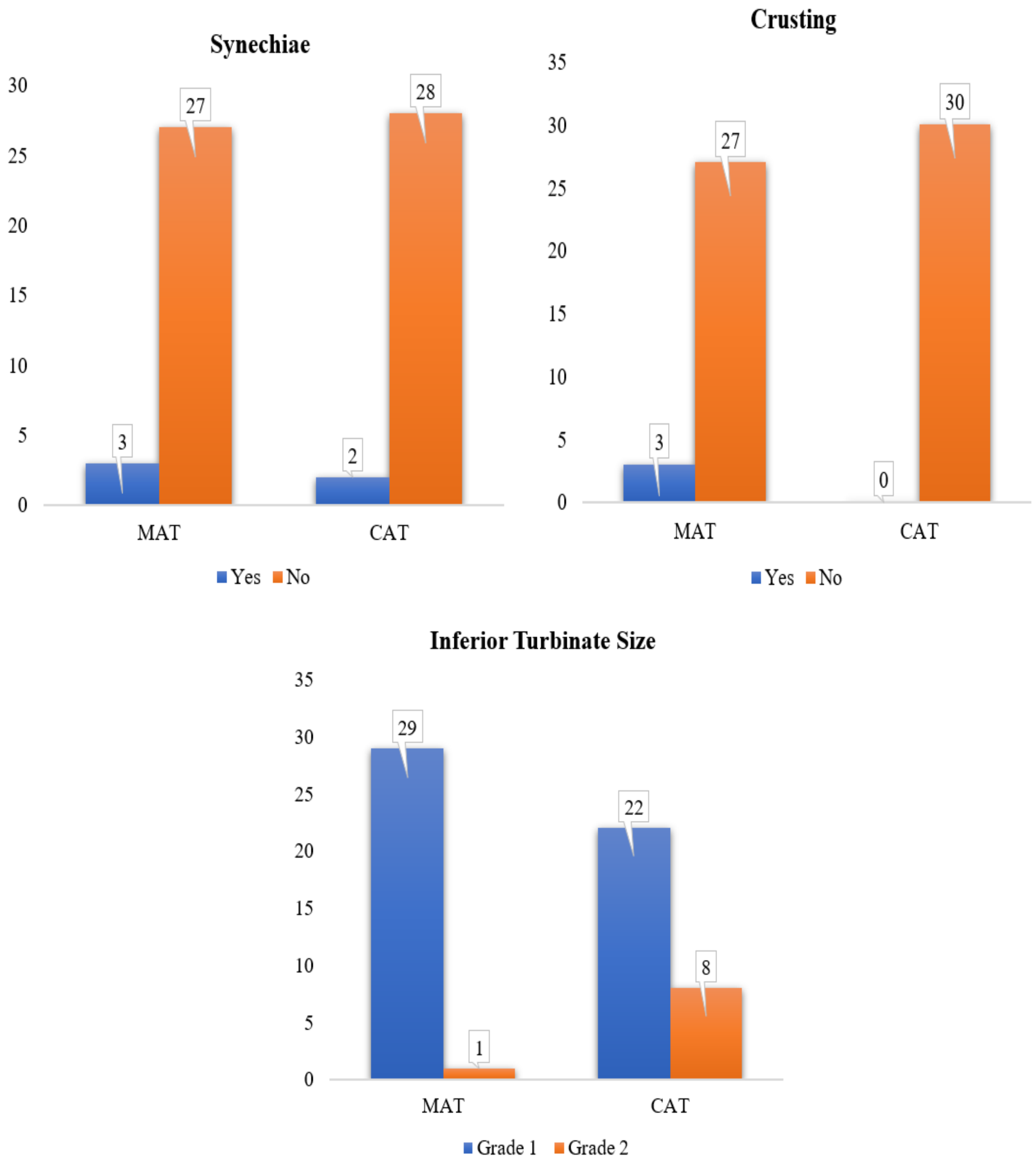


Table 12 Comparison of 2nd month post-operative nasal endoscopy findings across both surgeries (N=60)

Signs		Surgery		P-value
		MAT	CAT	
Synechiae	Yes	3 (10%)	2 (6.7%)	1.0#
	No	27 (90%)	28 (93.3%)	
Crusting	Yes	3 (10%)	0	0.237#
	No	27 (90%)	30 (100%)	
Inferior Turbinate Size	Grade 1	29 (96.7%)	22 (73.3%)	0.026#
	Grade 2	1 (3.3%)	8 (26.7%)	

#*Fisher's exact test*

At the 2-month post-operative follow-up, nasal endoscopy findings indicated further improvement in healing outcomes across both surgical techniques compared to the 7th post-operative day. Synechiae formation was minimal in both groups, with 3 cases (10%) in the microdebrider-assisted turbinoplasty (MAT) group and 2 cases (6.7%) in the coblation-assisted turbinoplasty (CAT) group, showing no significant difference (p = 1.0). Crusting, which was more prevalent at day 7, had significantly reduced by 2 months. While 3 patients (10%) in the MAT group still exhibited minor crusting, there were no cases in the CAT group, though the difference was not statistically significant (p = 0.237). The complete resolution of crusting in the CAT group suggests superior mucosal healing over time compared to the MAT group.

Inferior turbinate size reduction remained significantly different between the two groups. Grade 1 turbinate size was achieved in a higher proportion of patients in the MAT group (29 patients, 96.7%) compared to the CAT group (22 patients, 73.3%), while grade 2 turbinate size was more common in the CAT group (8 patients, 26.7%) than in the MAT group (1 patient, 3.3%) (p = 0.026). These findings indicate that while both techniques resulted in sustained improvement in turbinate size over time, the microdebrider technique remained superior in achieving greater turbinate size reduction. Overall, by the 2-month follow-up, both methods showed substantial resolution of synechiae and crusting, with coblation demonstrating better healing outcomes and microdebrider achieving greater turbinate reduction (Figure 23, Table 12).

Figure 24:Comparison of 3rd month post-operative nasal endoscopy findings across both surgeries (N=60)

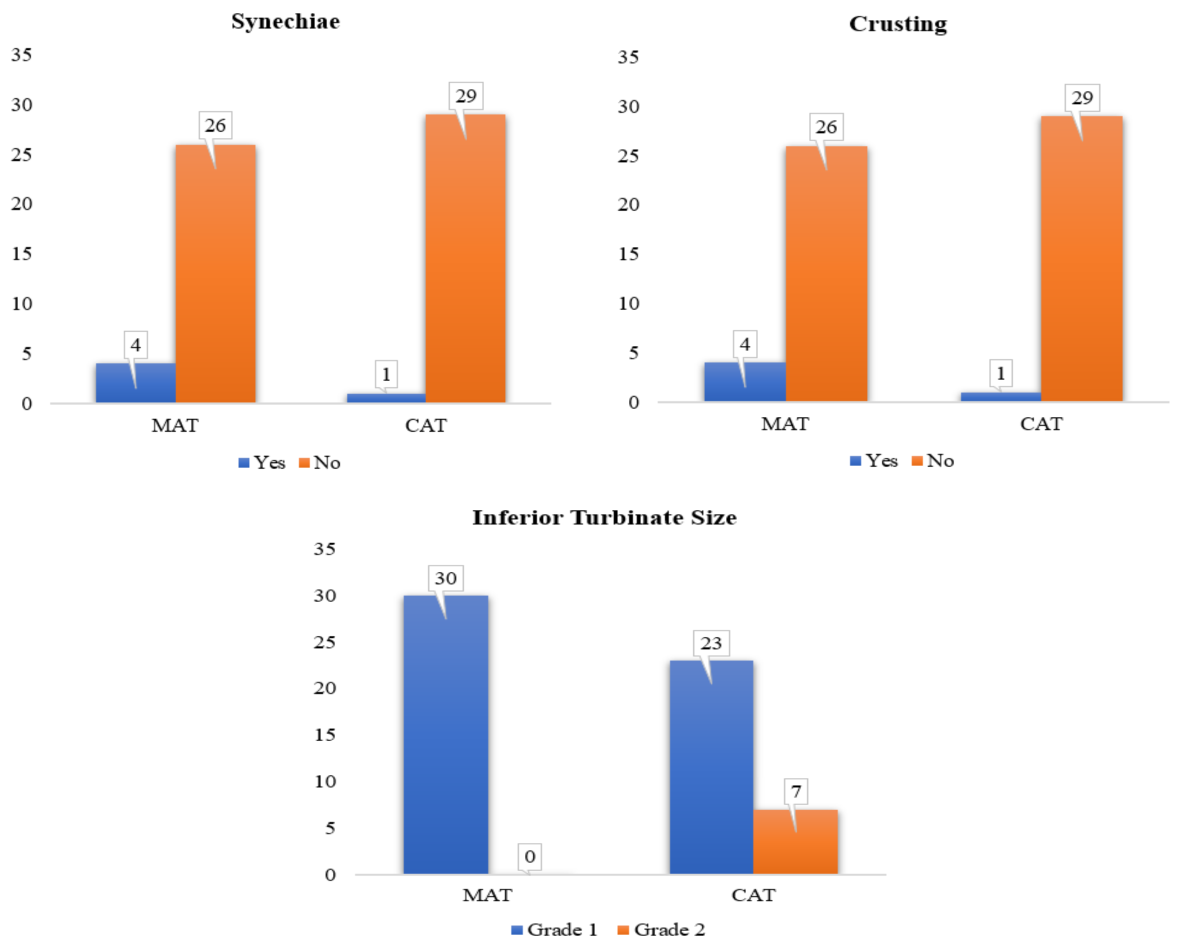


Table 13 Comparison of 3rd month post-operative nasal endoscopy findings across both surgeries (N=60)

Signs		**Surgery**		**P-value**
		MAT	**CAT**	
Synechiae	Yes	4 (13.3%)	1 (3.3%)	0.353#
	No	26 (86.7%)	29 (96.7%)	
Crusting	Yes	0	0	-
	No	0	0	
Inferior Turbinate Size	Grade 1	30 (100%)	23 (76.7%)	0.011#
	Grade 2	0	7 (23.3%)	

By the 3rd post-operative month, nasal endoscopy findings demonstrated continued improvement in healing outcomes across both surgical techniques. Synechiae formation remained minimal, with 4 patients (13.3%) in the microdebrider-assisted turbinoplasty (MAT) group and only 1 patient (3.3%) in the coblation-assisted turbinoplasty (CAT) group, showing no significant difference between the two groups (p = 0.353). Crusting, which had been present at earlier follow-ups, was completely absent in both groups by the 3rd month, indicating complete mucosal recovery and normalization of nasal surfaces.

Inferior turbinate size showed further refinement, with all patients in the MAT group (30 patients, 100%) achieving grade 1 turbinate size, whereas in the CAT group, 23 patients (76.7%) reached grade 1 while the remaining 7 patients (23.3%) had grade 2 turbinate size. This difference was statistically significant (p = 0.011), confirming that the microdebrider technique remained more effective in achieving greater turbinate size reduction compared to coblation-assisted turbinoplasty. These findings indicate that while both techniques led to complete resolution of crusting and minimal synechiae formation, the microdebrider method resulted in superior long-term turbinate reduction (Figure 24, Table 13).

Summary of results

The results of this study provide a comparative analysis of microdebrider-assisted turbinoplasty and coblation-assisted turbinoplasty, highlighting differences in intraoperative and post-operative outcomes. While both techniques were effective in reducing turbinate hypertrophy and improving nasal symptoms, notable differences were observed in specific parameters, particularly in the early post-operative period.

Intraoperatively, coblation-assisted turbinoplasty demonstrated superior hemostasis, resulting in significantly lower blood loss (mean 5 ± 1.5 ml) compared to the microdebrider technique (mean 10.5 ± 1.7 ml, $p < 0.001$), with a very large effect size (Cohen's d = 3.76). Despite this, the operative time was comparable between the two groups, with no statistically significant difference ($p = 0.124$), suggesting that the choice of technique does not impact surgical duration.

In the early post-operative period, coblation-assisted turbinoplasty provided notable advantages. At six hours post-surgery, pain scores were significantly lower in the coblation group (mean 4 ± 1.5) compared to the microdebrider group (mean 5 ± 1.2, $p = 0.007$). Additionally, post-operative bleeding was entirely absent in the coblation group, whereas 40% of patients in the microdebrider group experienced bleeding ($p < 0.001$), further supporting the hemostatic benefits of coblation.

By the seventh day, the trend of improved recovery in the coblation group continued. Pain scores remained significantly lower ($p < 0.001$), and nasal obstruction showed a slight improvement in the coblation group, though the difference was not statistically significant ($p = 0.173$). Endoscopic evaluation revealed that synechiae formation was slightly higher in the microdebrider group (13.3%) compared to the coblation group

(3.3%), though not statistically significant ($p = 0.353$). However, crusting was significantly more frequent in the microdebrider group (30%) than in the coblation group (3.3%, $p < 0.001$), indicating that coblation facilitated superior early mucosal healing and reduced post-operative complications.

By the second month, most symptoms had resolved in both groups, except for nasal obstruction, which remained significantly lower in the coblation group (median 0.5, IQR: 0–1) compared to the microdebrider group (median 2, IQR: 1–2, $p < 0.001$), suggesting better long-term nasal airway improvement with coblation. Endoscopic findings showed that synechiae and crusting were minimal in both groups, with no statistically significant differences. However, a higher proportion of patients in the coblation group had residual Grade 2 turbinate size (26.7%) compared to only 3.3% in the microdebrider group ($p = 0.026$). This suggests that while coblation was associated with better mucosal healing, the microdebrider technique resulted in a more complete turbinate size reduction.

By the third month, both surgical techniques showed near-complete symptom resolution, with no significant differences in nasal obstruction or other complaints. Synechiae formation remained slightly more common in the microdebrider group (13.3%) compared to the coblation group (3.3%), though the difference was not significant ($p = 0.353$). Crusting had fully resolved in both groups. The difference in turbinate size reduction persisted, with all patients in the microdebrider group achieving Grade 1 turbinate size, whereas 23.3% of patients in the coblation group still had residual Grade 2 hypertrophy ($p = 0.011$).

Both microdebrider-assisted and coblation-assisted turbinoplasty effectively improved nasal obstruction and symptom relief. However, key distinctions emerged between the two techniques. Coblation resulted in significantly lower intraoperative blood loss and completely eliminated post-operative bleeding, indicating a clear hemostatic advantage. Post-operative pain and crusting were significantly lower in the coblation group, supporting a smoother early recovery with better mucosal healing. Microdebrider-assisted turbinoplasty resulted in greater long-term turbinate size reduction, achieving a higher proportion of Grade 1 turbinate size at three months. Coblation demonstrated superior long-term nasal obstruction relief, suggesting that despite achieving slightly less turbinate size reduction, it provided better airflow improvement.

In conclusion, coblation-assisted turbinoplasty offers a more favorable post-operative recovery with reduced bleeding, pain, and crusting, making it a preferred option for minimizing complications. Meanwhile, microdebrider-assisted turbinoplasty remains more effective in achieving complete turbinate size reduction in the long term. The choice between the two techniques should be guided by patient-specific needs, balancing the advantage of better healing with coblation against the more pronounced anatomical turbinate reduction achieved with the microdebrider.

DISCUSSION

Microdebrider-Assisted Inferior Turbinoplasty (MAT) and Coblation-Assisted Inferior Turbinoplasty (CAT) are two widely used surgical techniques for managing inferior turbinate hypertrophy, a common cause of nasal obstruction. While both procedures aim to alleviate nasal airway resistance and improve patient symptoms, they differ in their underlying mechanisms, intraoperative characteristics, and postoperative outcomes. MAT employs a high-speed rotating blade to mechanically reduce the hypertrophied turbinate tissue, whereas CAT uses radiofrequency energy to achieve controlled tissue ablation with concurrent hemostasis. Given the distinct approaches of these techniques, a comprehensive comparison is essential to determine their relative efficacy and safety. This study evaluates the clinical outcomes of MAT and CAT in terms of symptom resolution, turbinate size reduction, intraoperative efficiency, and postoperative complications, providing insights that may guide clinicians in selecting the most appropriate intervention for patients with chronic nasal obstruction.

The study included a total of 60 participants, evenly distributed between the MAT and CAT groups. The mean age of participants in the MAT group was 27.6 ± 12 years, while the CAT group had a higher mean age of 36.3 ± 15.5 years, though this difference was not statistically significant (p = 0.283). Gender distribution was also comparable between the two groups (p = 0.592), supporting the validity of randomization and minimizing potential confounding factors.

Preoperative symptom assessment revealed that nasal obstruction was the most prevalent complaint, with a mean severity score of 8.3 ± 1.2, underscoring the necessity of surgical intervention. Other symptoms such as headache (2.5 ± 2.5) and snoring (1.6 ± 2.0) were also reported, albeit with lower intensity. Nasal endoscopy findings demonstrated that the majority of patients presented with grade 3 or 4 turbinate hypertrophy (50% and 48.3%, respectively), highlighting the substantial disease burden in the study population.

Intraoperative outcomes showed a significant difference in blood loss between the two techniques. The mean blood loss in the MAT group was 10.5 ± 1.7 ml, whereas the CAT group exhibited significantly lower bleeding at 5 ± 1.5 ml ($p < 0.001$). This highlights the superior hemostatic effect of CAT, which may contribute to better surgical visualization and reduced perioperative morbidity. However, the total duration of surgery was similar for both techniques, with a median operative time of 20 minutes in each group ($p = 0.124$), indicating comparable procedural efficiency.

Postoperatively, patients in the CAT group experienced significantly lower pain scores at six hours (mean 4 ± 1.5) compared to those in the MAT group (mean 5 ± 1.2, $p = 0.007$). Furthermore, while 40% of patients in the MAT group experienced postoperative bleeding, none of the patients in the CAT group reported this complication ($p < 0.001$), reaffirming the superior hemostatic properties of coblation. On the 7th postoperative day, pain remained significantly lower in the CAT group (median score: 0, IQR: 0–1) compared to the MAT group (median score: 2, IQR: 1–2, $p < 0.001$). Nasal obstruction showed a slight improvement in the CAT group, although the difference was not statistically significant ($p = 0.173$). Crusting was significantly more frequent in the MAT group (30%) compared to the CAT group (3.3%, $p < 0.001$), indicating that coblation promotes better early mucosal healing. While synechiae formation was slightly higher in the MAT group (13.3%) than in the CAT group (3.3%), this difference was not statistically significant ($p = 0.353$).

By the second postoperative month, symptom resolution was observed across both groups, with pain completely subsiding. Nasal obstruction remained significantly lower in the CAT group (median 0.5, IQR: 0–1) compared to the

MAT group (median 2, IQR: 1–2, $p < 0.001$), suggesting better long-term nasal airflow improvement with coblation. Endoscopic findings showed minimal crusting and synechiae formation in both groups, with no statistically significant differences. However, a greater proportion of patients in the CAT group had residual Grade 2 turbinate size (26.7%) compared to the MAT group (3.3%, $p = 0.026$), indicating that MAT achieved a more pronounced reduction in turbinate hypertrophy.

By the third postoperative month, both groups showed near-complete symptom resolution. Synechiae formation remained slightly higher in the MAT group (13.3%) than in the CAT group (3.3%), though the difference was not significant ($p = 0.353$). Crusting had fully resolved in both groups. The difference in turbinate size reduction persisted, with all patients in the MAT group achieving Grade 1 turbinate size, whereas 23.3% of patients in the CAT group still had residual Grade 2 hypertrophy ($p = 0.011$). These findings indicate that while both techniques effectively alleviate nasal obstruction, MAT may offer superior anatomical turbinate size reduction, whereas CAT provides better long-term airflow improvement.

In conclusion, both microdebrider-assisted and coblation-assisted turbinoplasty significantly improved nasal obstruction and symptom relief. However, distinct advantages were observed with each technique. Coblation-assisted turbinoplasty demonstrated superior hemostatic control, lower postoperative pain, and reduced crusting, making it a preferred option for minimizing early postoperative complications and promoting faster recovery. In contrast, microdebrider-assisted turbinoplasty achieved greater long-term turbinate size reduction, which may be beneficial in patients requiring more extensive tissue removal. The choice between these techniques should be guided by patient-specific factors, balancing the advantage of enhanced healing with coblation against the greater anatomical reduction provided by the microdebrider technique.

Our findings align with and differ from those of Lee et al[74]. (2009), which assessed long-term outcomes of MAT and CAT. Both studies confirm that MAT achieves greater turbinate size reduction, while CAT offers better hemostasis and recovery. However, differences in methodology, follow-up, and evaluation metrics may account for variations in results. Lee et al. studied 60 patients with nasal obstruction refractory to medical treatment, assessing outcomes at 3, 6, and 12 months using nasal obstruction scores and acoustic rhinometry. Our study, also with 60 participants, focused on intraoperative and early postoperative parameters with follow-ups at 7 days, 2 months, and 3 months.

Both studies found significant improvement in nasal obstruction. Lee et al. reported superior long-term symptom relief with MAT, supported by greater cross-sectional area and nasal cavity volume increases at 12 months. Our study, in contrast, found that CAT led to better nasal obstruction relief at 2 months ($p < 0.001$), while MAT showed superior turbinate size reduction at 3 months ($p = 0.011$). This suggests CAT provides earlier symptomatic relief, while MAT offers more lasting anatomical reduction.

Complications varied. Our study showed CAT had significantly lower intraoperative blood loss (5 ± 1.5 ml vs. 10.5 ± 1.7 ml, $p < 0.001$) and no post-operative bleeding (vs. 40% in MAT, $p < 0.001$). Lee et al. did not find significant differences in bleeding but reported similar crusting between techniques. Our study found significantly lower postoperative crusting with CAT at 7 days ($p < 0.001$), indicating better early mucosal healing. Surgical time was similar in both studies ($p = 0.124$). Pain scores in our study were significantly lower with CAT at 6 hours ($p = 0.007$) and 7 days ($p < 0.001$), while Lee et al. did not specifically evaluate early pain. Both studies confirm the effectiveness of MAT and CAT but highlight different advantages. Our study emphasizes CAT's benefits in early recovery with reduced bleeding, pain, and crusting, while MAT provides better long-term turbinate reduction. Lee et al. suggest MAT may offer more sustained airway improvement.

Hegazi et al[70]. examined 70 patients over six months, focusing on both subjective (VAS scores) and objective (turbinate size grading) outcomes. Our study, with 60 participants, incorporated intraoperative and early postoperative assessments with follow-ups at 7 days, 2 months, and 3 months. Both studies demonstrated significant symptom relief in both groups, though the patterns of recovery varied. In Hegazi et al., CAT provided earlier pain relief, with significantly lower pain scores at two days postoperatively ($p = 0.0001$), consistent with our findings at 6 hours and 7 days ($p = 0.007$ and $p < 0.001$, respectively). Similarly, both studies found CAT to be superior in reducing postoperative crusting and bleeding, reinforcing its hemostatic advantage.

Turbinate size reduction remained a differentiating factor. Hegazi et al. found comparable reductions between the groups at six months, whereas our study highlighted a more pronounced reduction with MAT at three months ($p = 0.011$). This suggests that while CAT ensures early symptom relief, MAT may offer a more sustained anatomical change. Complications were fewer with CAT in both studies. Hegazi et al. noted a lower incidence of adhesions (5% vs. 16.7% in MAT), aligning with our findings that CAT significantly minimized postoperative bleeding ($p < 0.001$). Unlike Hegazi et al., our study also showed that CAT had superior long-term nasal obstruction relief at two months ($p < 0.001$), further supporting its role in enhancing airflow dynamics.

Both our study and Kumar et al[75]. (2016) found CAT and MAT to be equally effective in relieving nasal obstruction up to six months postoperatively, with no major difference in surgical time or early symptom resolution. However, our study showed CAT had a significant hemostatic advantage, reducing postoperative bleeding ($p < 0.001$), while Kumar et al. found no significant difference in bleeding rates. Additionally, we observed MAT achieving more pronounced turbinate size reduction at three months ($p = 0.011$), whereas CAT sustained better nasal obstruction relief at two months ($p < 0.001$). Both studies highlight the effectiveness of these techniques, with CAT excelling in early recovery and hemostasis, while MAT provides lasting turbinate volume reduction.

Similarly, our study and the research by Singh et al. (2020) evaluated the efficacy and safety of Microdebrider-Assisted Turbinoplasty (MAT) and Coblation-Assisted Turbinoplasty (CAT) in treating inferior turbinate hypertrophy. Both studies found significant improvements in nasal symptoms and turbinate size reduction postoperatively for both techniques. However, Singh et al. reported no significant differences between MAT and CAT in terms of symptom relief and turbinate size reduction at various postoperative intervals, while our study observed a more pronounced reduction in turbinate size with MAT at three months ($p = 0.011$) and superior nasal obstruction relief with CAT at two months ($p < 0.001$). Additionally, Singh et al. found a longer operating time for CAT compared to MAT ($p = 0.001$), whereas our study did not find a significant difference in surgical time between the two procedures. Both studies reported minimal postoperative complications, suggesting that both MAT and CAT are safe and effective for treating inferior turbinate hypertrophy.

Jadhav et al[72]. (2022) assessed the effectiveness of microdebrider-assisted turbinoplasty and coblation-assisted turbinoplasty for inferior turbinate hypertrophy, demonstrating significant improvements in nasal obstruction, turbinate size reduction, and mucociliary transit time. Both studies used the NOSE score for evaluation, with Jadhav et al. reporting greater improvement with coblation at all follow-ups, while our study found comparable outcomes initially but superior long-term relief with coblation. Turbinate size reduction was significant in both studies, though Jadhav et al. observed greater reduction with the microdebrider, a finding consistent with our results showing pronounced anatomical reduction at three months. Mucociliary transit time was better preserved with coblation in both studies, suggesting less thermal damage and better mucosal function. Postoperative complications were minimal, though early crusting and synechiae were slightly more frequent with the microdebrider, resolving with time. Jadhav et al. noted a small risk of mucosal atrophy with excessive coblation use, an observation not prominent in our study but still a consideration. Overall, both studies highlight that coblation offers faster symptom relief and better mucosal preservation, while the microdebrider provides more definitive turbinate size reduction, reinforcing the need for individualized surgical selection based on patient needs.

Bhagat et al[73]. (2024) compared microdebrider-assisted and coblation-assisted turbinoplasty for inferior turbinate hypertrophy, assessing outcomes such as nasal obstruction relief, turbinate size reduction, intraoperative bleeding, and postoperative recovery. Both ours and Bhagat et. al. studies concluded that coblation and microdebrider techniques were more effective than submucous diathermy. Bhagat et al. reported that coblation had advantages in terms of reduced intraoperative bleeding and lower postoperative pain scores, findings consistent with our study, where coblation showed superior early postoperative comfort. Microdebrider, in contrast, achieved greater turbinate size reduction and better symptomatic improvement over time, a result echoed in our study, where microdebrider provided sustained anatomical reduction at later follow-ups. Postoperative crusting was initially higher with the microdebrider in both studies, but resolved over time. Bhagat et al. noted that the preference for submucous diathermy remains due to cost and ease of use, despite its lower efficacy, a point not directly addressed in our study but relevant for practical considerations. Both studies reaffirm that coblation offers better immediate symptom relief and reduced complications, while the microdebrider provides more definitive long-term anatomical improvement, supporting individualized procedural selection.

In conclusion, both microdebrider-assisted and coblation-assisted turbinoplasty effectively alleviate nasal obstruction and improve patient symptoms, but each technique offers distinct advantages. Coblation-assisted turbinoplasty demonstrates superior hemostatic control, reduced postoperative pain, and faster mucosal healing, making it an ideal choice for patients requiring early symptom relief with minimal complications. On the other hand, microdebrider-assisted turbinoplasty achieves greater long-term turbinate size reduction, which may be beneficial in cases requiring more extensive tissue removal. While early recovery is better with coblation, sustained anatomical reduction is more pronounced with the microdebrider, suggesting that procedural selection should be tailored to patient-specific needs and severity of turbinate hypertrophy. Future research with extended follow-up and larger sample sizes could further refine the understanding of long-term outcomes, ensuring optimal surgical planning for individualized patient care.

CONCLUSION

This study compared microdebrider-assisted turbinoplasty (MAT) and coblation-assisted turbinoplasty (CAT) as surgical modalities for the management of inferior turbinate hypertrophy refractory to medical therapy. Both techniques demonstrated clinically significant improvements in nasal airway patency, symptom relief, and postoperative healing. The findings suggest that MAT and CAT are comparable in terms of overall efficacy, patient-reported outcomes, and complication rates, reinforcing their role as effective mucosal-sparing techniques for turbinate reduction.

While MAT allowed for precise tissue resection with a controlled debulking effect, CAT offered a hemostatic advantage with reduced intraoperative bleeding and a minimally invasive tissue ablation approach. Both techniques effectively preserved nasal physiology by maintaining mucosal integrity, reducing the risk of excessive crusting and atrophic changes commonly associated with aggressive turbinectomy procedures. The comparable symptom relief and sustained long-term benefits observed in both groups suggest that the choice between these methods can be tailored based on surgeon expertise, intraoperative conditions, and patient-specific factors.

Given the comparable outcomes between MAT and CAT, both methods can be effectively utilized in clinical practice. Additionally, a cost-effectiveness analysis may help determine the economic viability of each technique in different healthcare settings. Overall, this study supports both MAT and CAT as safe and effective surgical options for patients with persistent nasal obstruction due to turbinate hypertrophy, contributing to the growing body of evidence favoring minimally invasive, mucosa-preserving approaches in rhinologic surgery.

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+hypertrophies+by+magnetic+resonance+imaging.+Laryngoscope+2007%3B+117%3A+623-627.&oq=Sapci+T%2C+Usta+C%2C+Evcimik+MF%2C+et+al.+Evaluation+of+radiofrequency+thermal+ablation+results+in+inferior+turbinate+hypertrophies+by+magnetic+resonance+imaging.+Laryngoscope+2007%3B+117%3A+623-627.&gs_lcrp=EgZjaHJvbWUyBggAEEUYOdIBBzY4MmowajeoAgiwAgE&sourceid=chrome&ie=UTF-8

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ANNEXURE I

ETHICAL CLEARANCE CERTIFICATE

Azadi Ka Amrit Mahotsav

BLDE

(DEEMED TO BE UNIVERSITY)

Declared as Deemed to be University u/s 3 of UGC Act, 1956

Accredited with 'A' Grade by NAAC (Cycle-2)

The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 985/2022-23 10/4/2023

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Saturday, 18th March, 2023 at 11.30 a.m. in the CAL Laboratory, Dept. of Pharmacology,** scrutinizes the Synopsis/ Research Projects of Post Graduate Student / Under Graduate Student /Faculty members of this University /Ph.D. Student College from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "MICRODEBRIDER-ASSISTED TURBINOPLASTY VERSUS COBLATION METHOD OFTURBINOPLASTY"- A COMPARATIVE STUDY.

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: DR.RESHMA RAJEEV.

NAME OF THE GUIDE: DR. H.T.LATHADEVI. PROFESSOR AND HOD, DEPT. OF OTORHINOLARYNGOLOGY.

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA

Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University)
Vijayapura

Dr.Akram A. Naikwadi
Member Secretary
IEC, BLDE (DU),
VIJAYAPURA

MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

Following documents were placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
BLDE (DU): Phone: +918352-262770, Fax: +918352-263303, Website: www.bldedu.ac.in, E-mail:office@bldedu.ac.in
College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

ANNEXURE – II

PROFORMA

MICRODEBRIDER- ASSISTED TURBINOPLASTY VERSUS COBLATION METHOD OF TURBINOPLASTY - A COMPARATIVE STUDY

1. Date of surgery

2. Patient UHID No:

3. Patient Name

4. Patient Age

5. Sex

   Mark only one oval.

   ◯ Male

   ◯ Female

6. Randomized Surgery

   ◯ MAT

   ◯ CAT

7. Smptom Scale_preoperatively:

	0 (No symptom)	1	2	3	4	5	6	7	8	9	10 (Most Severe)
Nasal Obstruction	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Sneezing	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Rhinorrhea	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Hyposmia	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Headache	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Snoring	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Dry mouth upon waking/ sleeping with mouth open	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭

8.Nasal Endoscopy_Inferior Turbinate size_preop

- ⬭ Grade 1
- ⬭ Grade 2
- ⬭ Grade 3
- ⬭ Grade 4

8. Time taken for the surgery
in minutes

____

9. Total intraoperative bleeding
in ml

____

10. Post-op 6 hours Pain

	0	1	2	3	4	5	6	7	8	9	10	
No Pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Most severe pain

11. Post-op_6 hours bleeding

Mark only one oval.

◯ Yes

◯ No

12. No. of analgesics consumed

____

13. Pot-op nasal packing requirement until discharge

◯ Yes

◯ No

14. Pain_7th day

	0	1	2	3	4	5	6	7	8	9	10	
No pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Severe Pain

15. Symptom Scale_7th day

	0 (No symptom)	1	2	3	4	5	6	7	8	9	10 (Most Severe)
Nasal Obstruction											
Sneezing											
Rhinorrhea											
Hyposmia											
Headache											
Snoring											
Dry mouth upon waking/ sleeping with mouth open											

16. Synechiae_7th day

- Yes
- No

17. Crusting 7th day

- Yes
- No

18. Nasal Endoscopy_Inferior Turbinate size_7th day

- Grade 1
- Grade 2
- Grade 3
- Grade 4

19. Symptom Scale_2nd month

	0 (No symptom)	1	2	3	4	5	6	7	8	9	10 (Most Severe)
Nasal Obstruction											
Sneezing											
Rhinorrhea											
Hyposmia											
Headache											
Snoring											
Dry mouth upon waking/ sleeping with mouth open											

20. Synechiae_2nd month

- Yes
- No

21. Crusting_2nd month

- Yes
- No

22. Nasal Endoscopy_Inferior Turbinate size_2nd month

- Grade 1
- Grade 2
- Grade 3
- Grade 4

23. Symptom Scale_3rd month

	0 (No symptom)	1	2	3	4	5	6	7	8	9	10 (Most Severe)
Nasal Obstruction	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Sneezing	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Rhinorrhea	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Hyposmia	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Headache	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Snoring	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Dry mouth upon waking/ sleeping with mouth open	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭	⬭

24. Synechiae_3rd month

- ⬭ Yes
- ⬭ No

25. Crusting_3rd month

- ⬭ Yes
- ⬭ No

26. Nasal Endoscopy_Inferior Turbinate size_3rd month(Camacho et al)

- Grade 1
- Grade 2
- Grade 3
- Grade 4

ANNEXURE –III

INFORMED CONSENT FORM

BLDE (deemed to be university)

SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND

RESEARCH CENTRE , VIJAYAPURA- 586103.

BLDE (Deemed to be university) SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA- 586103

TITLE OF THE PROJECT

"MICRODEBRIDER- ASSISTED TURBINOPLASTY VERSUS COBLATION METHOD OF TURBINOPLASTY - A COMPARATIVE STUDY"

PG STUDENT - Dr. RESHMA RAJEEV

DEPARTMENT OF
OTORHINOLARYNGOLOGY

PG GUIDE - Dr. H T LATHADEVI
PROFESSOR
DEPARTMENT OF
OTORHINOLARYNGOLOGY
SHRI B. M. PATIL MEDICAL COLLEGE
HOSPITAL AND RESEARCH CENTRE,
VIJAYAPUR, KARNATAKA– 586103

All aspects of this consent form are explained to the patient in the language understood by him/her.

1) PURPOSE OF RESEARCH:

I have been informed about this study. I have also been given a free choice of participation in this study.

2) PROCEDURE:

I am aware that in addition to routine care received I will be asked series of questions by the investigator. I have been asked to undergo the necessary investigations and treatment, which will help the investigator in this study

2) **RISK AND DISCOMFORTS:**

I understand that I may experience some pain and discomfort during the examination or during my treatment. This is mainly the result of my condition and the procedure of this study is not expected to exaggerate these feelings that are associated with the usual course of treatment.

3) BENEFITS:

I understand that my participation in this study will help to the patients survival and better outcome.

4) CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of Hospital records and will be subject to the confidentiality and privacy regulation. Information of a sensitive personal nature will not be a part of the medical records, but will be stored in the investigator's research file and identified only by a code number. The code-key connecting name to numbers will be kept in a separate location.

If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand that I may see the photographs and videotapes and hear the audiotapes before giving this permission.

5) REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at anytime. DR.RESHMA RAJEEV is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation.

If during the study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. A copy of this consent form will be given to me to keep for careful reading.

7) REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital. I also understand that DR. RESHMA RAJEEV may terminate my participation in the study after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician or physical therapist, if this is appropriate.

8) INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study, if such injury were reported promptly, the appropriate treatment would be available to me, but no further compensation would be provided. I understand that by my agreement to participate in this study I am not waiving any of my legal rights.

I have explained to ____________________________the purpose of the research, the procedures required and the possible risks and benefits to the best of my ability in patient's own language.

_____________________ _____________________

Dr. DR. RESHMA RAJEEV Date

(Investigator)

STUDY SUBJECT CONSENT STATEMENT

I confirm that DR. RESHMA RAJEEV has explained to me the purpose of research, the study procedures that I will undergo, and the possible risks and discomforts as well as benefits that I may experience in my own language.

I have read and I understand this consent form. Therefore, I agree to give consent to participate as a subject in this research project.

____________________________ ____________________________

Participant / Guardian Date

____________________________ ____________________________

Witness to signature Date

ANNEXURE IV
PLAGERISM CHECK

Reshma Rajeev

Reshma Rajeev.docx

BLDE University

Document Details

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Submission Date
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ANNEXURE V : MASTER CHART

Date of surgery	Patient Age	Sex	Randomized Surgery	Nasal Obstruction_Preop	Sneezing_Preop	Rhinorrhea_Preop	Hyposmia_Preop	Headache_Preop	Snoring_Preop	Dry mouth upon waking/sleeping with mouth open_Preop	Nasal Endoscopy_Inferior Turbinate size_preop	Time taken for the surgery	Total intraoperative bleeding	Post-op_6 hours Pain	Post-op_6 hours bleeding	No. of analgesics consumed	Post-op nasal packing requirement until discharge	Pain_7th day	Nasal Obstruction_7th day	Sneezing_7th day	Rhinorrhea_7th day	Hyposmia_7th day	Headache_7th day	Snoring_7th day	Dry mouth upon waking/sleeping with mouth open_7th day	Synechiae_7th day	Crusting_7th day	Nasal Endoscopy_Inferior Turbinate size_7th day	Nasal Obstruction_2nd month	Sneezing_2nd month	Rhinorrhea_2nd month	Hyposmia_2nd month	Headache_2nd month	Snoring_2nd month	Dry mouth upon waking/sleeping with mouth open_2nd month	Synechiae_2nd month	Crusting_2nd month	Nasal Endoscopy_Inferior Turbinate size_2nd month	Nasal Obstruction_3rd month	Sneezing_3rd month	Rhinorrhea_3rd month	Hyposmia_3rd month	Headache_3rd month	Snoring_3rd month	Dry mouth upon waking/sleeping with mouth open_3rd month	Synechiae_3rd month	Crusting_3rd month	Nasal Endoscopy_Inferior Turbinate size_3rd month (Camacho et al)
	12	Female	CAT	7	4	3	0	0	3	1	Grade 3	21	10	5	No	1	No	1	3	2	2	0	0	1	1	No	No	Grade 1	1	1	0	0	0	0	0	No	No	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1
30-04-2024	21	Female	CAT	7	3	2	1	3	3	0	Grade 3	20	5	6	No	1	No	2	6	1	1	0	2	1	0	No	No	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
13-01-2024	25	Male	CAT	8	3	3	0	3	0	0	Grade 3	23	7	5	No	1	No	2	3	0	0	0	2	0	0	No	No	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
16-06-2023	55	Male	CAT	9	0	0	0	6	4	3	Grade 3	18	5	2	No	1	No	0	4	0	0	0	3	3	2	No	No	Grade 2	0	0	0	0	0	1	0	No	No	Grade 1	0	0	0	0	0	0	0	Yes	No	Grade 1
21-06-2023	35	Male	CAT	7	1	1	0	0	1	0	Grade 4	20	7	3	No	1	No	0	2	0	0	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
22-3-2024	18	Male	CAT	8	2	2	0	0	0	0	Grade 4	18	5	5	No	1	No	1	4	1	1	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 2
7-6-2023	36	Male	CAT	8	2	2	0	2	0	0	Grade 3	18	5	4	No	1	No	1	4	1	1	0	1	0	0	No	No	Grade 2	1	0	0	0	0	0	0	Yes	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 2
1/12/23	24	Male	CAT	9	3	3	1	5	3	3	Grade 4	14	8	4	No	1	No	1	3	1	1	1	1	0	0	No	No	Grade 1	1	0	0	0	0	0	0	Yes	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 2
16-03-2023	27	Female	CAT	7	3	3	0	3	2	2	Grade 3	23	4	3	No	1	No	1	4	0	0	0	0	1	1	No	No	Grade 2	2	0	0	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1
22/1/24	48	Male	CAT	9	0	0	0	5	3	3	Grade 4	20	5	4	No	1	No	1	5	0	0	0	3	0	0	No	No	Grade 2	1	0	0	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 2
13-03-2023	17	Male	CAT	10	0	0	0	8	5	5	Grade 3	18	4	3	No	1	No	1	4	0	0	0	1	2	2	No	No	Grade 1	1	0	0	0	0	1	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
9/3/2023	57	Male	CAT	9	0	0	0	9	7	2	Grade 4	24	6	5	No	2	No	2	4	0	0	0	2	2	0	No	Yes	Grade 2	1	0	0	0	0	2	0	No	No	Grade 2	0	0	0	0	0	2	0	No	No	Grade 2
7/3/2023	56	Female	CAT	10	1	2	1	7	0	3	Grade 4	20	6	4	No	1	No	0	5	0	1	0	2	0	0	No	No	Grade 2	1	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
3/3/2023	68	Female	CAT	7	0	0	0	0	0	0	Grade 3	20	4	4	No	1	No	0	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
1/3/2023	26	Female	CAT	8	0	0	0	0	3	3	Grade 4	20	3	3	No	1	No	0	4	0	0	0	0	1	1	No	No	Grade 2	2	0	0	0	0	1	1	No	No	Grade 2	0	0	0	0	0	1	0	No	No	Grade 2
21-02-2023	67	Male	CAT	7	0	0	2	2	2	2	Grade 3	21	4	2	No	1	No	0	3	0	0	1	1	1	0	No	No	Grade 1	0	0	0	0	0	1	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
20-02-2023	44	Male	CAT	10	0	0	0	6	6	6	Grade 3	23	5	1	No	1	No	0	3	0	0	0	2	2	1	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	1	0	0	0	0	No	No	Grade 1
20-01-2023	45	Female	CAT	9	0	0	2	9	2	2	Grade 3	22	5	3	No	1	No	0	2	0	0	0	0	1	1	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
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20-06-2023	35	Male	CAT	7	0	0	0	0	1	0	Grade 3	21	5	4	No	1	No	0	2	0	0	0	0	1	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
3/4/2023	35	Male	CAT	10	0	0	0	0	0	3	Grade 4	20	4	3	No	1	No	0	2	0	0	0	0	0	1	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
5/4/2023	30	Male	CAT	9	0	0	0	5	0	0	Grade 3	16	5	3	No	1	No	0	4	0	0	0	2	0	0	No	No	Grade 2	1	0	0	0	0	0	0	No	No	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1
25-05-2023	20	Female	CAT	10	0	0	0	8	0	0	Grade 3	25	3	7	No	1	No	0	3	0	0	0	1	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
21-04-2023	42	Female	CAT	10	0	0	0	4	4	4	Grade 3	17	4	4	No	1	No	2	2	0	0	0	1	2	2	No	No	Grade 2	2	0	0	0	0	1	1	No	No	Grade 2	2	0	0	0	0	2	2	No	No	Grade 2
25-04-2023	17	Male	CAT	8	0	0	0	1	4	4	Grade 3	20	3	2	No	1	No	0	2	0	0	0	0	1	1	Yes	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1

2/5/2023	16	Male	CAT	10	0	0	0	0	7	7	Grade 4	23	4	6	No	1	No	0	3	0	0	0	0	3	3	No	No	Grade 1	1	0	0	0	0	2	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
5/5/2023	49	Female	CAT	9	0	0	0	0	0	0	Grade 3	27	6	6	No	1	No	0	3	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
########	45	Male	CAT	6	0	0	0	3	0	0	Grade 2	21	3	2	No	1	No	0	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
########	48	Female	CAT	10	0	0	0	0	3	3	Grade 4	21	5	2	No	1	No	0	2	0	0	0	0	1	1	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
3/1/2023	35	Male	MAT	9	0	0	0	3	3	3	Grade 3	22	10	5	Yes	1	No	2	7	0	0	0	1	1	1	No	No	Grade 2	3	0	0	0	0	0	0	No	No	Grade 2	1	0	0	0	0	0	0	No	No	Grade 1
########	46	Female	MAT	6	0	0	0	0	2	0	Grade 4	15	9	5	Yes	1	No	2	4	0	0	0	0	1	0	No	Yes	Grade 1	3	0	0	0	0	1	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
20-01-2023	20	Male	MAT	8	2	0	0	0	0	0	Grade 3	22	12	6	Yes	1	No	1	3	0	0	0	1	0	0	No	No	Grade 1	1	0	0	0	0	0	0	Yes	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
27-02-2024	19	Male	MAT	8	0	0	0	3	3	0	Grade 3	22	12	7	No	2	No	0	4	0	0	0	0	1	0	No	No	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
2/9/2024	20	Male	MAT	7	0	0	0	3	0	0	Grade 3	20	10	6	No	1	No	2	4	0	0	0	0	0	0	No	No	Grade 2	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
27-01-2023	38	Female	MAT	9	2	0	0	0	0	2	Grade 3	21	12	4	No	1	No	1	3	2	0	0	0	0	1	No	Yes	Grade 2	2	1	0	0	0	0	0	No	No	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1
5/2/2023	33	Male	MAT	7	0	0	0	0	0	1	Grade 3	19	12	3	No	1	No	0	5	0	0	0	0	0	1	No	Yes	Grade 2	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
9/2/2023	45	Female	MAT	8	0	0	0	2	0	2	Grade 4	18	9	5	Yes	1	No	1	4	0	0	0	1	0	0	No	No	Grade 2	2	0	0	0	0	0	0	Yes	No	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1
14-02-2023	26	Female	MAT	8	0	0	2	3	0	2	Grade 4	20	10	7	Yes	2	No	3	5	0	0	2	2	0	2	No	No	Grade 1	3	0	0	0	1	0	0	No	No	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1
17-02-2023	28	Male	MAT	9	2	0	0	3	0	0	Grade 4	17	11	5	No	1	No	0	4	0	0	0	2	0	0	No	No	Grade 2	2	0	0	0	0	0	0	No	No	Grade 1	2	0	0	0	0	0	0	Yes	No	Grade 1
20-02-2023	20	Male	MAT	8	0	0	0	0	0	2	Grade 4	22	10	4	Yes	1	No	2	4	0	0	0	0	0	0	No	No	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
23-08-2024	29	Male	MAT	8	0	0	0	2	2	0	Grade 4	16	12	5	No	1	No	0	4	0	0	0	1	1	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
19-08-2024	27	Male	MAT	8	0	0	0	0	0	0	Grade 3	23	14	6	No	2	No	3	6	0	2	0	0	0	0	Yes	Yes	Grade 1	2	0	0	0	0	0	0	No	Yes	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
16-07-2024	35	Female	MAT	8	0	0	0	3	0	3	Grade 4	20	12	6	No	2	No	4	4	0	0	0	1	0	0	No	Yes	Grade 2	2	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
15-07-2024	47	Male	MAT	6	0	0	0	2	2	2	Grade 4	17	12	3	No	1	No	2	3	0	0	1	1	1	0	No	No	Grade 2	2	0	0	0	0	1	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
6/7/2024	18	Male	MAT	9	2	0	0	2	0	0	Grade 3	21	12	5	No	1	No	2	4	0	0	1	2	0	0	Yes	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
17-06-2024	21	Female	MAT	8	0	0	0	2	0	2	Grade 4	12	8	6	No	1	No	1	3	0	0	0	0	0	0	No	No	Grade 2	3	0	0	0	0	0	0	Yes	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
29-05-2024	18	Female	MAT	8	0	0	2	2	0	2	Grade 4	20	11	4	Yes	1	No	2	4	0	0	1	1	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
2/5/2024	13	Male	MAT	9	0	0	4	4	4	4	Grade 4	18	10	4	Yes	1	No	2	6	0	0	1	2	2	2	No	No	Grade 1	2	0	0	0	0	1	1	No	No	Grade 1	1	0	0	0	0	1	1	No	No	Grade 1
2/5/2024	16	Male	MAT	7	0	0	0	0	0	0	Grade 3	22	12	5	No	1	No	2	4	0	0	0	0	0	0	No	Yes	Grade 1	1	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
28-02-2024	17	Female	MAT	8	0	0	0	0	0	0	Grade 4	17	10	4	No	1	No	1	5	0	0	2	0	0	0	Yes	No	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1	3	0	0	0	0	0	0	Yes	No	Grade 1
9/1/2024	27	Male	MAT	7	0	0	0	3	0	0	Grade 3	16	10	3	Yes	1	No	2	3	0	0	0	3	0	0	No	No	Grade 1	0	0	0	0	2	0	0	No	No	Grade 1	2	0	0	0	1	0	0	Yes	No	Grade 1
8/8/24	16	Male	MAT	9	0	0	0	0	0	0	Grade 3	19	9	6	Yes	1	No	0	6	0	0	0	0	0	0	No	No	Grade 1	3	0	0	0	0	0	0	No	Yes	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
13-02-2024	25	Male	MAT	8	0	0	0	4	4	4	Grade 4	19	12	3	No	1	No	2	5	0	0	0	1	2	2	No	No	Grade 1	1	0	0	0	1	1	0	No	No	Grade 1	0	0	0	0	1	1	0	No	No	Grade 1
24-02-2023	56	Male	MAT	6	0	0	0	2	2	0	Grade 3	20	9	5	No	1	No	1	4	0	0	0	2	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
13-03-2023	17	Male	MAT	10	2	0	0	2	0	2	Grade 4	22	9	4	No	1	No	1	6	0	0	2	0	0	0	Yes	Yes	Grade 1	1	0	0	0	1	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
21-03-2023	56	Male	MAT	9	0	0	0	0	4	0	Grade 4	22	7	4	No	1	No	2	4	0	0	0	0	2	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1	3	0	0	0	2	0	0	Yes	No	Grade 1
24-03-2023	25	Female	MAT	10	0	0	0	4	0	0	Grade 4	19	8	3	Yes	1	No	2	4	0	0	0	0	0	0	No	No	Grade 1	2	0	1	0	0	0	0	No	No	Grade 1	0	0	0	0	0	0	0	No	No	Grade 1
3/6/2023	17	Female	MAT	7	0	0	0	0	0	0	Grade 3	18	8	7	No	2	No	3	3	0	0	0	0	0	0	No	Yes	Grade 1	2	0	0	0	0	0	0	No	Yes	Grade 1	2	0	0	0	0	0	0	No	No	Grade 1
27-06-2023	18	Male	MAT	10	0	0	0	5	5	0	Grade 4	21	12	4	Yes	1	No	1	5	0	0	0	2	1	0	No	Yes	Grade 1	2	0	0	0	2	2	0	No	No	Grade 1	2	0	0	0	2	2	0	No	No	Grade 1