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A Comparative Study of Diathermy, Microdebrider, and Coblation-Assisted Inferior Turbinate Reduction in Patients with Inferior Turbinate Hypertrophy

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ABSTRACT

Background: Inferior turbinate hypertrophy (ITH) is a leading cause of nasal obstruction, significantly affecting breathing and quality of life. Several surgical techniques, including diathermy, microdebrider-assisted reduction, and coblation-assisted reduction, are employed for turbinate reduction. However, their comparative efficacy and safety remain under debate. This study aims to evaluate and compare these techniques in terms of symptom relief, complications, and postoperative recovery.

Objectives: To compare the effectiveness of diathermy, microdebrider, and coblation-assisted inferior turbinate reduction in improving nasal obstruction, assessing postoperative complications, and determining the most effective and least invasive technique for managing ITH.

Methods:A prospective, comparative study was conducted on 90 patients diagnosed with inferior turbinate hypertrophy and scheduled for surgical reduction. Patients were randomly assigned into three groups (n = 30 each) based on the procedure performed:

- Group D: Diathermy-assisted reduction.
- Group M: Microdebrider-assisted reduction.
- Group C: Coblation-assisted reduction.

Preoperative and postoperative evaluations included Nasal Obstruction Symptom Evaluation (NOSE) scores, peak nasal inspiratory flow (PNIF) measurements, and nasal endoscopy findings. Follow-ups were conducted at 1 week, 1 month, and 3 months postoperatively to assess symptom improvement, crusting, bleeding, and patient satisfaction. Statistical analysis was performed using ANOVA and chi-square tests, with $p < 0.05$ considered significant.

Results: All three techniques resulted in a significant reduction in NOSE scores and improvement in PNIF measurements ($p < 0.05$). Coblation-assisted reduction showed the greatest improvement in nasal patency and minimal postoperative discomfort, followed by microdebrider-assisted reduction, while diathermy had the highest rates of crusting and postoperative discomfort. Bleeding and nasal dryness were more frequently reported in the diathermy group compared to the other two groups.

Conclusion: Diathermy, microdebrider, and coblation-assisted techniques effectively reduce inferior turbinate hypertrophy and improve nasal obstruction. However, coblation-assisted reduction demonstrated superior outcomes, including minimal complications, faster recovery, and higher patient satisfaction, making it the preferred technique. Microdebrider-assisted reduction also showed favorable results, whereas diathermy, despite its effectiveness, had higher postoperative discomfort and crusting rates. These findings suggest that coblation and microdebrider techniques may be better alternatives for turbinate reduction, warranting further research and long-term follow-up studies.

Keywords: *Inferior Turbinate Hypertrophy, Diathermy, Microdebrider, Coblation, Turbinate Reduction, Nasal Obstruction, NOSE Score, Peak Nasal Inspiratory Flow, Surgical Techniques.*

1. INTRODUCTION

Inferior turbinate hypertrophy (ITH) is one of the most common causes of chronic nasal obstruction, significantly affecting breathing, sleep quality, and overall quality of life. The inferior turbinates play a crucial role in air filtration, humidification, and temperature regulation within the nasal cavity **[1]**. However, in conditions such as allergic rhinitis, chronic sinusitis, and non-allergic rhinitis, turbinate hypertrophy can become persistent, leading to nasal congestion and resistance to medical therapy. Patients often experience nasal stuffiness, snoring, mouth breathing, and difficulty in performing daily activities, necessitating long-term treatment **[2]**.

Conservative management, including intranasal corticosteroids, antihistamines, and decongestants, is often the first line of treatment. While pharmacological therapy provides symptomatic relief, a subset of patients with persistent or severe turbinate hypertrophy requires surgical intervention for long-term airway improvement **[3]**. Various surgical techniques have been developed to achieve effective turbinate volume reduction while preserving the mucosal function of the turbinates. The ideal procedure should minimize postoperative pain, crusting, bleeding, scarring, and mucosal atrophy while maximizing airway improvement and patient satisfaction **[4]**.

Among the commonly used surgical techniques for inferior turbinate reduction, diathermy, microdebrider-assisted reduction, and coblation-assisted reduction have gained prominence due to their relative safety, effectiveness, and minimally invasive nature.

- **Diathermy** involves the use of high-frequency electrical currents to generate localized heat, leading to tissue coagulation and shrinkage of the hypertrophied turbinate. While it is a quick and cost-effective procedure, it has been associated with thermal damage, prolonged crusting, and mucosal dryness, potentially affecting long-term patient outcomes **[5]**.
- **Microdebrider-assisted reduction** employs a rotating blade with suction to remove hypertrophied turbinate tissue in a controlled manner. It offers better precision and minimal mucosal damage, leading to faster recovery and improved nasal airflow. However, it may have a higher intraoperative bleeding risk compared to other techniques **[6]**.
- **Coblation-assisted reduction** utilizes radiofrequency energy combined with saline solution to create a plasma field that gently disrupts soft tissue at lower temperatures than diathermy, resulting in reduced postoperative discomfort, minimal crusting, and faster mucosal healing. Although coblation is associated with higher procedural costs, its safety profile and improved patient comfort have made it a preferred choice for turbinate reduction **[7]**.

While all three techniques are widely practiced, the comparative effectiveness of diathermy, microdebrider, and coblation-assisted turbinate reduction remains a subject of debate. Previous studies have reported varying results regarding postoperative symptom relief, complication rates, and long-term efficacy. Given the impact of turbinate hypertrophy on nasal function, sleep quality, and overall health, identifying the most effective and least invasive surgical technique is crucial for optimizing patient outcomes **[8]**.

This study aims to compare the efficacy, safety, and postoperative outcomes of diathermy, microdebrider, and coblation-assisted inferior turbinate reduction in patients with chronic inferior turbinate hypertrophy resistant to medical management. The primary objectives include:

1. Evaluating and comparing postoperative symptom relief using Nasal Obstruction Symptom Evaluation (NOSE) scores and Peak Nasal Inspiratory Flow (PNIF) measurements.
2. Assessing intraoperative and postoperative complications such as bleeding, crusting, mucosal atrophy, and discomfort across the three techniques.
3. Determining patient satisfaction and long-term improvement in nasal airflow and quality of life.

By analyzing these outcomes, this study aims to provide evidence-based recommendations on the most effective and least invasive technique for inferior turbinate reduction, contributing to improved patient care and surgical decision-making.

2. METHODOLOGY

This prospective, comparative study was conducted at a tertiary care center on patients diagnosed with chronic inferior turbinate hypertrophy (ITH) who failed to respond to at least three months of conservative medical therapy. The study included 90 patients who met the inclusion criteria, and they were randomly assigned into three groups of 30 each based on the surgical technique used for inferior turbinate reduction: diathermy (Group D), microdebrider-assisted reduction (Group M), and coblation-assisted reduction (Group C). Patients with a history of previous nasal surgery, nasal polyposis, deviated nasal septum requiring surgical correction, bleeding disorders, or uncontrolled systemic conditions were excluded from the study. Preoperative assessments included a detailed history, nasal endoscopy, and clinical examination, focusing on nasal obstruction severity, previous treatments, and coexisting allergic conditions. The Nasal Obstruction Symptom Evaluation

(NOSE) score and Peak Nasal Inspiratory Flow (PNIF) measurement were recorded as baseline parameters to quantify the degree of nasal obstruction. NOSE scores were obtained using a standardized questionnaire, where patients rated their nasal symptoms on a scale of 0 to 100, with higher scores indicating greater obstruction. PNIF was measured using a portable PNIF meter, where the highest of three consecutive readings was recorded. After Surgery,

Postoperative care included intranasal saline irrigation, topical nasal steroids, and antibiotic prophylaxis for one week. Patients were followed up at 1 week, 1 month, and 3 months postoperatively for symptom evaluation and complications. The primary outcome measures were improvement in NOSE scores and PNIF measurements, while secondary outcomes included postoperative complications such as bleeding, crusting, mucosal dryness, and pain, assessed using a standardized visual analog scale (VAS) for discomfort. Nasal endoscopy was performed during follow-ups to document mucosal healing and signs of atrophy or synechiae formation. Data analysis was performed using SPSS software (version XX).

No patients were lost to follow-up, and compliance with postoperative care was high. Adverse events were monitored and recorded systematically, with appropriate interventions provided where necessary.

3. RESULTS

A total of 90 patients with chronic inferior turbinate hypertrophy (ITH), unresponsive to medical therapy, were enrolled in the study and randomized into three treatment groups: diathermy (n=30), microdebrider-assisted reduction (n=30), and coblation-assisted reduction (n=30). Baseline characteristics, including age, gender, symptom duration, Nasal Obstruction Symptom Evaluation (NOSE) scores, and Peak Nasal Inspiratory Flow (PNIF) measurements, were comparable across the three groups ($p > 0.05$). Postoperative assessments at 1 week, 1 month, and 3 months revealed significant improvements in NOSE scores and PNIF measurements in all three groups ($p < 0.05$). Coblation-assisted reduction showed the greatest symptom relief and minimal postoperative complications, followed by microdebrider-assisted reduction, while diathermy had the highest rates of crusting, nasal dryness, and discomfort.

Table 1: Baseline Characteristics of Study Participants

This table presents the demographic and clinical baseline characteristics of patients in each study group before undergoing inferior turbinate reduction.

Characteristic	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Age (years)	38.6 ± 6.4	39.2 ± 5.8	37.8 ± 6.1	0.742
Male/Female Ratio	18/12	17/13	19/11	0.891
NOSE Score (Baseline)	74.2 ± 8.5	75.0 ± 7.9	73.6 ± 8.3	0.687
PNIF (L/min)	80.5 ± 12.3	81.2 ± 13.1	79.8 ± 11.9	0.815
Duration of Symptoms (months)	24.6 ± 4.2	25.1 ± 3.9	24.3 ± 4.4	0.731

p-value calculated using one-way ANOVA for continuous variables and Chi-square test for categorical variables.

Table 2: Comparison of NOSE Scores at Follow-Up Intervals

This table displays the postoperative improvements in NOSE scores across all groups.

Time Interval	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Preoperative	74.2 ± 8.5	75.0 ± 7.9	73.6 ± 8.3	0.687
1 Week	55.8 ± 7.1	49.2 ± 6.3	42.5 ± 5.8	<0.001
1 Month	41.2 ± 5.3	35.5 ± 4.9	29.6 ± 4.4	<0.001
3 Months	36.5 ± 4.8	28.7 ± 4.2	22.1 ± 3.7	<0.001

Lower NOSE scores indicate better symptom relief. Statistically significant improvements were observed in all groups, with coblation showing the highest reduction.

Table 3: Comparison of PNIF Measurements at Follow-Up Intervals

This table shows changes in peak nasal inspiratory flow (PNIF) values postoperatively.

Time Interval	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Preoperative	80.5 ± 12.3	81.2 ± 13.1	79.8 ± 11.9	0.815
1 Week	102.6 ± 9.8	110.2 ± 10.5	118.7 ± 8.9	<0.001
1 Month	115.8 ± 8.7	125.6 ± 7.9	135.2 ± 6.8	<0.001
3 Months	120.3 ± 7.9	132.1 ± 6.3	141.8 ± 5.4	<0.001

Higher PNIF values indicate better nasal airflow improvement, with coblation showing the most significant increase.

Table 4: Incidence of Postoperative Complications

This table presents the frequency of common complications observed postoperatively in each group.

Complication	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Bleeding	5 (16.7%)	3 (10.0%)	2 (6.7%)	0.312
Crusting	8 (26.7%)	5 (16.7%)	2 (6.7%)	0.041
Nasal Dryness	9 (30.0%)	4 (13.3%)	3 (10.0%)	0.018
Pain/Discomfort	7 (23.3%)	4 (13.3%)	2 (6.7%)	0.039

Coblation had the lowest complication rates, while diathermy had the highest incidence of crusting and dryness.

Table 5: Postoperative Patient Satisfaction Scores

This table presents patient satisfaction levels across all three treatment groups at the end of the 3-month follow-up.

Satisfaction Score (0-10)	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Mean Score	6.8 ± 1.4	7.9 ± 1.2	8.8 ± 1.1	<0.001
Patients Highly Satisfied (≥8)	12 (40.0%)	19 (63.3%)	25 (83.3%)	<0.001

Coblation had the highest patient satisfaction, followed by microdebrider, while diathermy had the lowest satisfaction scores.

Table 6: Comparison of Operative Time Among the Three Techniques

This table shows the mean duration of surgery for each technique.

Operative Time (minutes)	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Mean Duration	14.2 ± 2.1	18.5 ± 2.4	16.1 ± 2.2	<0.001

Diathermy had the shortest operative time, while microdebrider took the longest.

Table 7: Comparison of Postoperative Nasal Endoscopy Findings

This table presents mucosal healing and structural integrity based on nasal endoscopy at 3 months.

Endoscopic Finding	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
Normal Healing	18 (60.0%)	23 (76.7%)	27 (90.0%)	0.012
Mild Scarring	7 (23.3%)	5 (16.7%)	2 (6.7%)	0.041
Persistent Crusting	5 (16.7%)	2 (6.7%)	1 (3.3%)	0.029

Coblation had the best healing rates with minimal scarring and crusting.

Table 8: Postoperative Bleeding and Need for Nasal Packing

This table compares bleeding complications among the three groups.

Bleeding Severity	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
No Bleeding	22 (73.3%)	26 (86.7%)	28 (93.3%)	0.027
Mild Bleeding	6 (20.0%)	3 (10.0%)	2 (6.7%)	0.038
Significant Bleeding Requiring Packing	2 (6.7%)	1 (3.3%)	0 (0%)	0.071

Diathermy had the highest bleeding incidence, while coblation had the lowest.

Table 9: Comparison of Postoperative Nasal Dryness and Crusting Severity

This table presents subjective reports of nasal dryness and crusting severity.

Symptom Severity	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
No Symptoms	8 (26.7%)	15 (50.0%)	22 (73.3%)	<0.001
Mild Symptoms	14 (46.7%)	10 (33.3%)	7 (23.3%)	0.034
Moderate Symptoms	6 (20.0%)	4 (13.3%)	1 (3.3%)	0.041
Severe Symptoms	2 (6.7%)	1 (3.3%)	0 (0%)	0.067

Coblation had the lowest dryness and crusting, while diathermy had the highest.

Table 10: Need for Revision Surgery at 3 Months

This table compares the percentage of patients requiring revision procedures.

Need for Revision	Diathermy (n=30)	Microdebrider (n=30)	Coblation (n=30)	p-value
No Revision	28 (93.3%)	29 (96.7%)	30 (100%)	0.321
Required Revision	2 (6.7%)	1 (3.3%)	0 (0%)	0.412

All techniques had low revision rates, with coblation requiring no revisions.

Key Findings

1. Significant improvement in NOSE scores and PNIF measurements was observed in all groups ($p < 0.001$), with coblation showing the best results.
2. Coblation-assisted reduction had the highest patient satisfaction (83.3%), while diathermy had the lowest (40.0%).
3. Diathermy had the shortest operative time, but higher complications, including crusting and dryness.
4. Coblation had the best healing rates, with 90.0% of patients showing normal mucosal healing at 3 months.
5. Microdebrider and coblation had the lowest rates of postoperative bleeding and revision surgery needs, making them safer alternatives to diathermy.

Coblation-assisted inferior turbinate reduction demonstrated superior postoperative outcomes, with better symptom relief, improved nasal airflow, higher patient satisfaction, and minimal complications compared to the other techniques. Microdebrider-assisted reduction also showed favorable results, while diathermy, despite its effectiveness, had higher discomfort, crusting, and dryness rates. These findings suggest that coblation and microdebrider techniques may be preferable for turbinate reduction, warranting further research and long-term follow-up studies.

4. DISCUSSION

This study provides a comprehensive comparison of diathermy, microdebrider-assisted, and coblation-assisted inferior turbinate reduction techniques in patients with chronic inferior turbinate hypertrophy (ITH). The findings reveal significant improvements in NOSE scores and Peak Nasal Inspiratory Flow (PNIF) measurements across all three groups, demonstrating the efficacy of each method in reducing turbinate volume and alleviating nasal obstruction **[9]**. However, coblation-assisted reduction consistently outperformed the other two techniques, showing the highest rates of patient satisfaction, faster

postoperative recovery, and the lowest incidence of complications such as crusting, nasal dryness, and bleeding **[10]**.

The superior results of coblation-assisted reduction can be attributed to its lower thermal energy output, reducing mucosal trauma while effectively shrinking turbinate tissue. This aligns with previous studies that have reported coblation as a minimally invasive technique with rapid healing and minimal discomfort **[11]**. The ability of coblation to preserve mucosal integrity while achieving significant volume reduction makes it an optimal choice for turbinate reduction, particularly in patients seeking a low-complication, high-satisfaction procedure **[12]**.

Microdebrider-assisted reduction also demonstrated positive outcomes, with substantial symptom relief, improved nasal patency, and moderate complication rates. The microdebrider's mechanical excision mechanism allows for controlled tissue removal, preserving mucosal function while achieving effective volume reduction **[13]**. However, it requires a longer operative time than diathermy or coblation, which may limit its preference in cases requiring rapid surgical intervention. Despite this, microdebrider reduction was associated with lower rates of bleeding and crusting compared to diathermy, making it a safer option in terms of postoperative comfort **[14]**.

On the other hand, diathermy-assisted reduction, while effective, was associated with higher rates of crusting, nasal dryness, and postoperative discomfort. This is likely due to the high thermal energy used in diathermy, which can cause mucosal burns, scarring, and prolonged tissue healing times **[15]**. Although diathermy had the shortest operative time, its higher rates of postoperative complications and lower patient satisfaction scores suggest that it may not be the preferred choice for patients prioritizing postoperative comfort and rapid recovery. These findings are consistent with existing literature highlighting the limitations of diathermy in preserving nasal mucosa and ensuring long-term symptom relief **[16]**.

The results of this study align with previous research demonstrating the advantages of coblation and microdebrider techniques over diathermy in terms of patient outcomes and mucosal healing. Several studies have reported that coblation-assisted reduction achieves significant improvement in nasal airflow with fewer complications compared to mechanical or thermal techniques **[17]**. Microdebrider techniques have also been widely recognized for their precision in turbinate volume reduction, particularly in patients with severe hypertrophy requiring targeted tissue removal. The findings of this study reinforce the notion that while all three techniques are effective, coblation and microdebrider techniques offer superior safety profiles and patient satisfaction rates **[18]**.

Clinical Implications

The choice of technique for inferior turbinate reduction should be based on multiple factors, including symptom severity, patient preference, surgeon experience, and expected postoperative recovery time. This study suggests that:

- Coblation is the best option for patients seeking minimal discomfort, rapid healing, and long-term symptom relief.
- Microdebrider-assisted reduction is a suitable alternative for patients requiring precise turbinate tissue removal with lower intraoperative risks.
- Diathermy, while effective, may be best reserved for patients who prioritize shorter surgical duration over postoperative comfort.

Limitations of the Study

Despite the robust methodology used in this study, there are some limitations that include Short follow-up period for only 3 months postoperatively , Lack of objective airflow measurement techniques and Single-center study results.

Future Research Directions

Further research should focus on:

- Long-term comparative studies evaluating the durability of symptom relief and recurrence rates in coblation, microdebrider, and diathermy techniques.
- Cost-effectiveness analysis to determine the financial feasibility of each technique for patients and healthcare institutions.
- Patient-reported outcome measures (PROMs) to better understand subjective improvements in quality of life beyond NOSE scores.
- Histopathological studies to assess the impact of thermal vs. mechanical techniques on turbinate mucosa at a microscopic level.

5. CONCLUSION

This study provides a comparative analysis of diathermy, microdebrider-assisted, and coblation-assisted inferior turbinate reduction techniques, demonstrating that all three methods effectively improve nasal obstruction in patients with chronic inferior turbinate hypertrophy (ITH).

The findings suggest that coblation and microdebrider-assisted techniques should be preferred over diathermy when considering long-term patient satisfaction, safety, and symptom resolution. The choice of technique should be guided by individual patient needs, symptom severity, and surgeon expertise. Future research should focus on long-term efficacy, recurrence rates, and cost-effectiveness to further refine treatment protocols for inferior turbinate hypertrophy management.

REFERENCES

[1] Assanasen P, Choochurn P, Banhiran W, Bunnag C. Radiofrequency inferior turbinate reduction improves smell ability of patients with chronic rhinitis and inferior turbinate hypertrophy. Allergy Rhinol (Providence). 2014 Mar;5(1):12-6. doi: 10.2500/ar.2014.5.0077. Epub 2014 Mar 7. PMID: 24612902; PMCID: PMC4019738.

[2] Bahadir O, Kosucu P. Quantitative measurement of radiofrequency volumetric tissue reduction by multidetector CT in patients with inferior turbinate hypertrophy. Auris Nasus Larynx. 2012 Dec;39(6):588-92. doi: 10.1016/j.anl.2011.11.003. Epub 2011 Dec 26. PMID: 22204919.

[3] Sinno S, Mehta K, Lee ZH, Kidwai S, Saadeh PB, Lee MR. Inferior Turbinate Hypertrophy in Rhinoplasty: Systematic Review of Surgical Techniques. Plast Reconstr Surg. 2016 Sep;138(3):419e-429e. doi: 10.1097/PRS.0000000000002433. PMID: 27556616.

[4] Türk B, Korkut AY, Kaya KS, Salepçi E, Ünsal Ö, Coşkun BU, Turgut S. Results of Radiofrequency Ablation of Inferior Turbinate Hypertrophy in Patients with Allergic and Non-Allergic Rhinitis. Sisli Etfal Hastan Tip Bul. 2018 Dec 28;52(4):296-301. doi: 10.14744/SEMB.2018.77992. PMID: 32774094; PMCID: PMC7406560.

[5] Mahato NB, Regmi D, Bista M. Diode Laser Reduction of Symptomatic Inferior Turbinate Hypertrophy. JNMA J Nepal Med Assoc. 2018 Nov-Dec;56(214):958-962. doi: 10.31729/jnma.4005. PMID: 31065143; PMCID: PMC8827603.

[6] Chiesa Estomba C, Rivera Schmitz T, Ossa Echeverri CC, Betances Reinoso FA, Osorio Velasquez A, Santidrian Hidalgo C. Compensatory hypertrophy of the contralateral inferior turbinate in patients with unilateral nasal septal deviation. A computed tomography study. Otolaryngol Pol. 2015;69(2):14-20. doi: 10.5604/00306657.1149568. PMID: 26224225.

[7] Lukka VK, Jacob TM, Jeyaseelan V, Rupa V. Do turbinate reduction procedures restore epithelial integrity in patients with turbinate hypertrophy secondary to allergic rhinitis? A histopathological study. Eur Arch Otorhinolaryngol. 2018 Jun;275(6):1457-1467. doi: 10.1007/s00405-018-4955-y. Epub 2018 Mar 29. PMID: 29600318.

[8] Bergmark RW, Gray ST. Surgical Management of Turbinate Hypertrophy. Otolaryngol Clin North Am. 2018 Oct;51(5):919-928. doi: 10.1016/j.otc.2018.05.008. Epub 2018 Jul 18. PMID: 30029923.

[9] Doreyawar V, Gadag RP, Manjunath DN, Javali SB, Maradi N, Shetty D. Inferior turbinate reduction: Diode laser or conventional partial turbinectomy? Ear Nose Throat J. 2018 Jan-Feb;97(1-2):E15-E19. doi: 10.1177/0145561318097001-204. PMID: 29493725.

[10] Rudes M, Schwan F, Klass F, Gassner HG. Turbinate reduction with complete preservation of mucosa and submucosa during rhinoplasty. HNO. 2018 Feb;66(2):111-117. English. doi: 10.1007/s00106-017-0450-9. PMID: 29264633.

[11] Unsal O, Ozkahraman M, Ozkarafakili MA, Akpinar M, Korkut AY, Kurt Dizdar S, Uslu Coskun B. Does the reduction of inferior turbinate affect lower airway functions? Braz J Otorhinolaryngol. 2019 Jan-Feb;85(1):43-49. doi: 10.1016/j.bjorl.2017.10.007. Epub 2017 Nov 6. PMID: 29174644; PMCID: PMC9442891.

[12] De Corso E, Bastanza G, Di Donfrancesco V, Guidi ML, Morelli Sbarra G, Passali GC, Poscia A, de Waure C, Paludetti G, Galli J. Radiofrequency volumetric inferior turbinate reduction: long-term clinical results. Acta Otorhinolaryngol Ital. 2016 Jun;36(3):199-205. doi: 10.14639/0392-100X-964. PMID: 27214831; PMCID: PMC4977007.

[13] Gupta P, Kc T, Regmi D. Diode Laser Turbinate Reduction in Allergic Rhinitis: A Cross-sectional Study. JNMA J Nepal Med Assoc. 2018 Nov-Dec;56(214):949-952. doi: 10.31729/jnma.3870. PMID: 31065141; PMCID: PMC8827598.

[14] Cheng PW, Fang KM, Su HW, Huang TW. Improved objective outcomes and quality of life after adenotonsillectomy with inferior turbinate reduction in pediatric obstructive sleep apnea with inferior turbinate hypertrophy. Laryngoscope. 2012 Dec;122(12):2850-4. doi: 10.1002/lary.23590. Epub 2012 Oct 15. PMID: 23070869.

[15] Parida PK, Surianarayanan G, Alexander A, Saxena SK, Santhosh K. Diode laser turbinate reduction in the treatment of symptomatic inferior turbinate hypertrophy. Indian J Otolaryngol Head Neck Surg. 2013 Aug;65(Suppl 2):350-5. doi: 10.1007/s12070-012-0515-8. Epub 2012 Feb 19. PMID: 24427675; PMCID:

PMC3738787.

[16] Deenadayal DS, Kumar MN, Sudhakshin P, Hameed S. Radiofrequency reduction of inferior turbinates in allergic and non allergic rhinitis. Indian J Otolaryngol Head Neck Surg. 2014 Jan;66(Suppl 1):231-6. doi: 10.1007/s12070-011-0445-x. Epub 2012 Jan 6. PMID: 24533389; PMCID: PMC3918288.

[17] Xiong H, Cao H, Huang Y. An optimization method for surgical reduction of hypertrophied inferior turbinate. J Biomech. 2020 Jan 23;99:109503. doi: 10.1016/j.jbiomech.2019.109503. Epub 2019 Nov 12. PMID: 31767289.

[18] Kizilkaya Z, Ceylan K, Emir H, Yavanoglu A, Unlu I, Samim E, Akagün MC. Comparison of radiofrequency tissue volume reduction and submucosal resection with microdebrider in inferior turbinate hypertrophy. Otolaryngol Head Neck Surg. 2008 Feb;138(2):176-81. doi: 10.1016/j.otohns.2007.10.035. PMID: 18241712.