



OLFACTION IN ENDOSCOPIC SINUS AND SKULL BASE SURGERY

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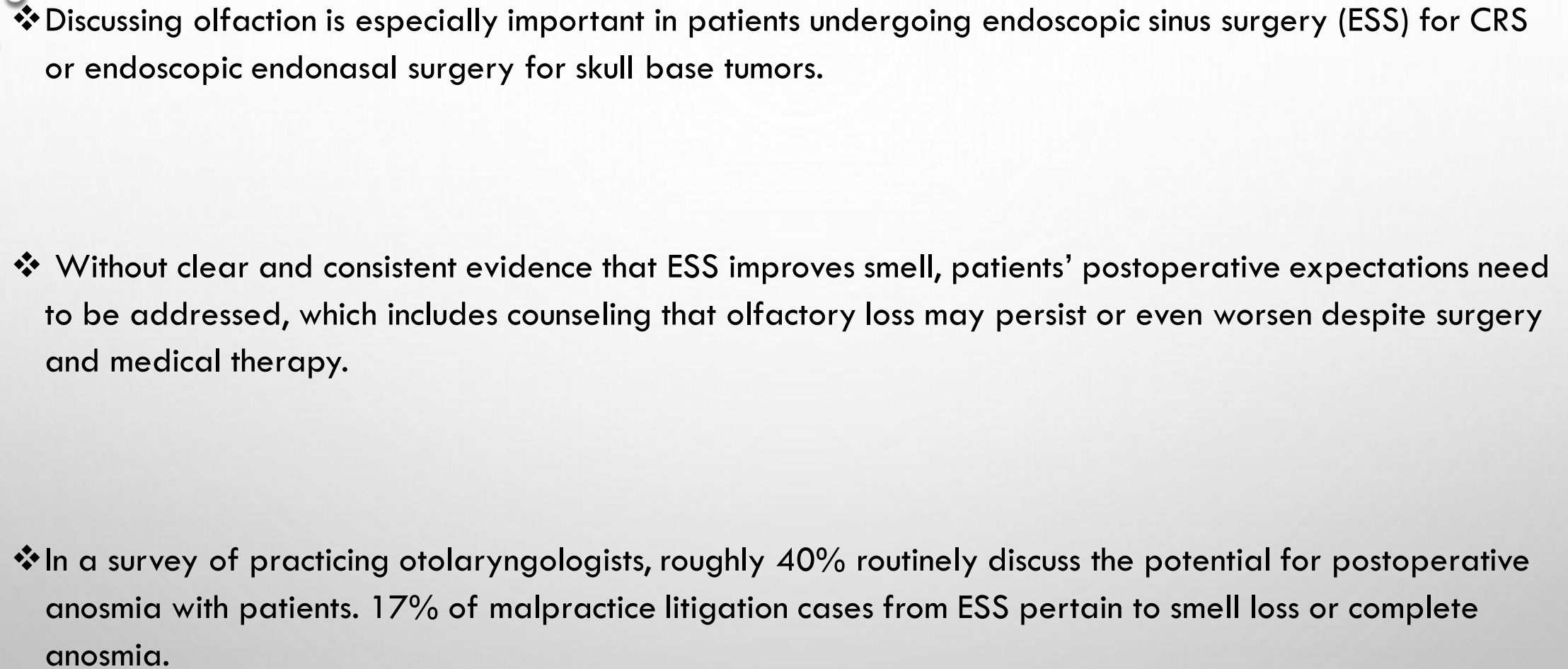
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INTRODUCTION

Olfactory dysfunction is a common complaint for patients visiting otolaryngology offices, with chronic rhinosinusitis (CRS) accounting for 14% to 25% of patients.

Of patients with CRS, 28% to 84% complain of a decreased sense of smell.

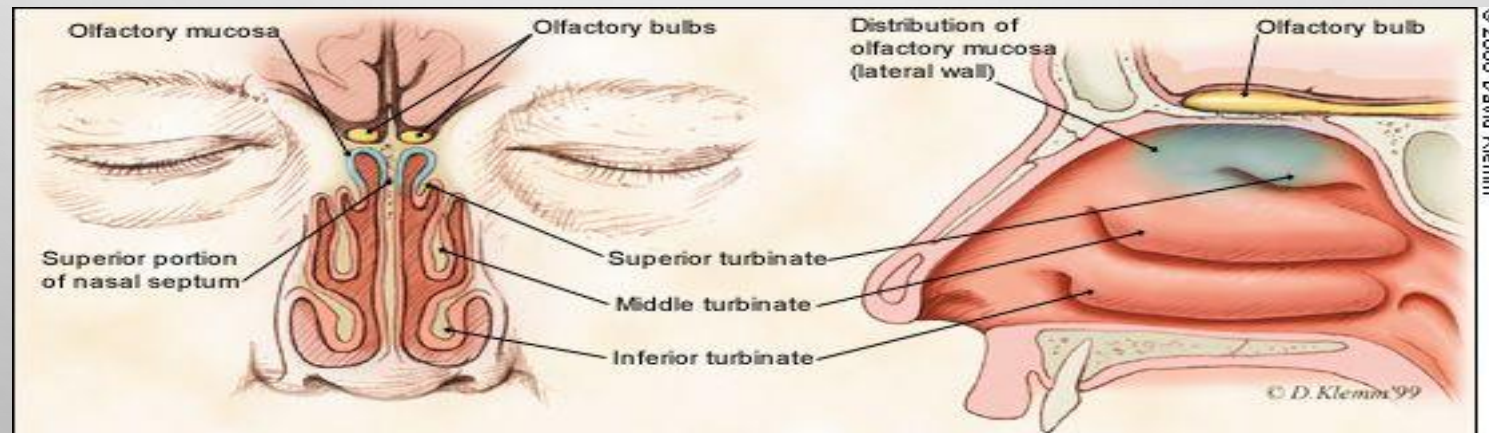
Hyposmia decreases a person's enjoyment of food and can reduce their overall quality of life. Furthermore, the inability to detect spoiled food, fire, toxic fumes, and gas leaks can be dangerous.

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- ❖ Discussing olfaction is especially important in patients undergoing endoscopic sinus surgery (ESS) for CRS or endoscopic endonasal surgery for skull base tumors.
 - ❖ Without clear and consistent evidence that ESS improves smell, patients' postoperative expectations need to be addressed, which includes counseling that olfactory loss may persist or even worsen despite surgery and medical therapy.
 - ❖ In a survey of practicing otolaryngologists, roughly 40% routinely discuss the potential for postoperative anosmia with patients. 17% of malpractice litigation cases from ESS pertain to smell loss or complete anosmia.

OLFACTION ANATOMY AND PHYSIOLOGY

The olfactory cleft is composed of pseudostratified columnar epithelium located below the cribriform plate and extending inferiorly along the septum for about 1 cm.

Parasagittally, the olfactory epithelium is roughly 2 cm in length along the superoposterior septum and can extend posteriorly to the face of the sphenoid sinus and laterally to the upper portion of the superior and middle turbinates



❖ **There are 2 mechanisms by which chronic rhinosinusitis decreases olfaction:**

- I. The obstruction of the olfactory cleft from polyps, nasal discharge, and mucosal edema decreases the ability of the odorant to reach the olfactory receptors.
- II. Underlying epithelial inflammatory damage from CRS can affect the health of the olfactory neurons or the neurons' ability to transmit olfaction to the brain.

Addressing olfaction with patients who have CRS is important, because a loss of smell is correlated with a lower quality of life.

Table 4.1 Common Causes of Olfactory Dysfunction

Conductive

Rhinosinusitis
Nasal polyposis
Nasal cavity tumor

Sensorineural

Post-URI/viral
Trauma and head injury
Congenital
Toxins
Medications
Aging
Neurodegenerative disorders
 Alzheimer disease
 Parkinson disease

Abbreviations: URI, upper respiratory infection.

CONDUCTIVE OLFACTORY LOSS

Olfactory loss is likely a major reason why patients with CRS with nasal polyps (CRSWNP) **have a greater chance of smell loss** than patients with CRS without nasal polyps (CRSSNP).

Study found that higher scores on both the LUND-MCKAY radiologic score and the LUND-KENNEDY endoscopy score correlated with smell loss in patients with CRSWNP.

In patients with CRSSNP, the LUND- KENNEDY score only weakly correlated with smell loss, and there was no correlation with severity of LUND-MCKAY score.

Besides overall LUND-MCKAY score, several investigators have shown that **Increased opacification** on (CT) specifically within the olfactory cleft correlates with **worsening results on olfactory testing**.

One study graded the olfactory cleft opacification on CT scan as mild (0%–25%), moderate (25%–75%), and severe (>75%).

Six months postoperatively the improvement in olfactory scores, on both the odor threshold and identification tests, was significantly **better in the mild group** than in the moderate or severe groups.

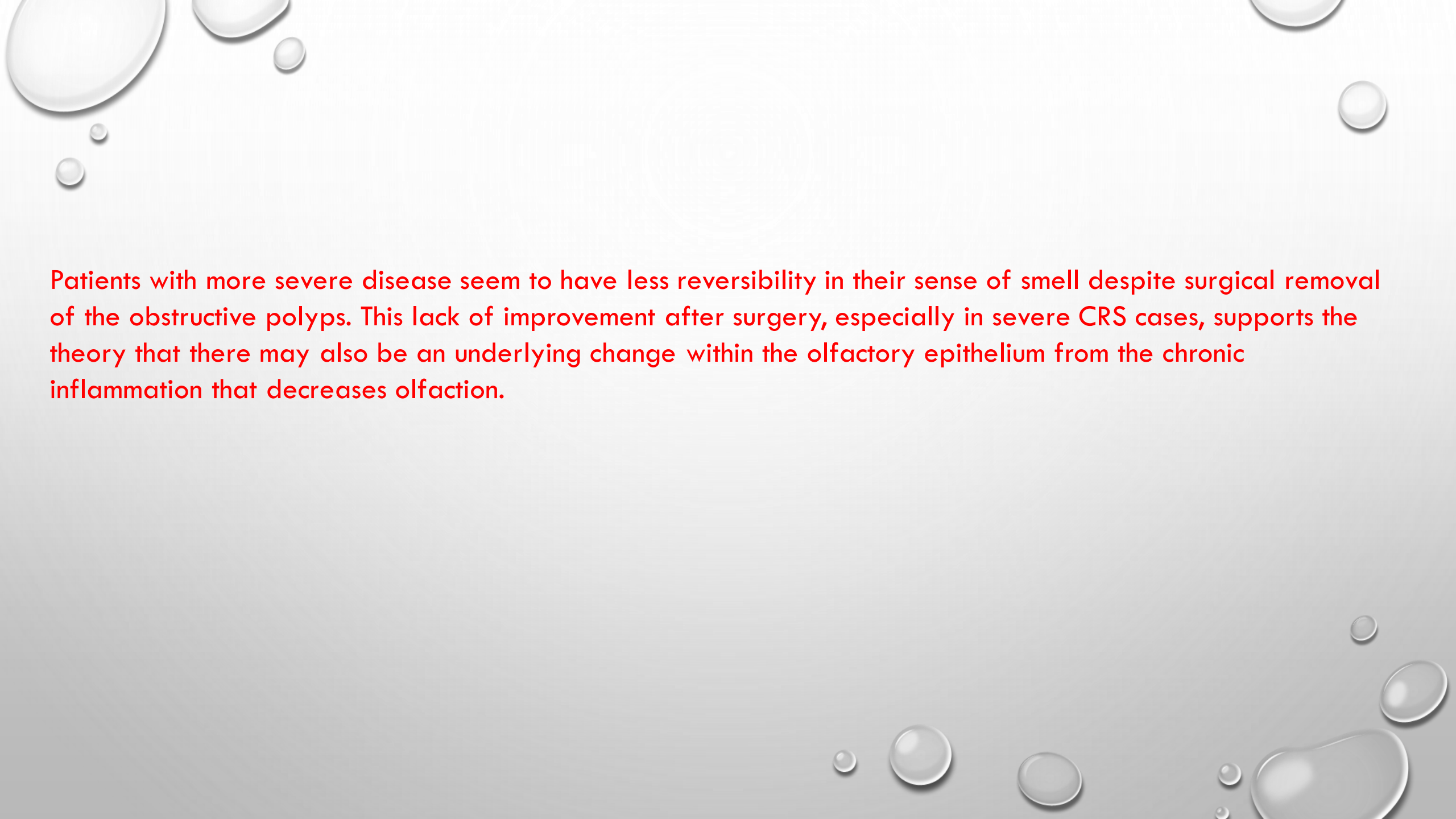
Kim dw, kim jy, jeon sy. The status of the olfactory cleft may predict postoperative olfactory function in chronic rhinosinusitis with nasal polyposis. Am J rhinol allergy 2011;25(2):e90–4.

The BTT results were improved after surgery in 87% of the mild group, 45% of the moderate group, and 50% of the severe group.

A **return to normosmia** on the BTT was significantly better in the mild group at 76% , compared with 34% in the moderate group, and 13% in the severe group.

There was also a significant difference in the postoperative recovery rate on the CCSIT, in which 85% of the mild group showed recovery in olfactory identification compared with only 43% in the moderate group, and 53% in the severe group.

A **return to normosmia** on the CCSIT was 50% in the mild group compared with only 17% in the moderate group, and 6% in the severe group



Patients with more severe disease seem to have less reversibility in their sense of smell despite surgical removal of the obstructive polyps. This lack of improvement after surgery, especially in severe CRS cases, supports the theory that there may also be an underlying change within the olfactory epithelium from the chronic inflammation that decreases olfaction.

INFLAMMATORY CHANGES TO THE OLFACTORY EPITHELIUM IN CHRONIC RHINOSINUSITIS

❖ Biopsies from the olfactory cleft studied of patients undergoing ESS or septoplasty.

19 olfactory epithelium biopsy specimens obtained , 10 had an influx of lymphocytes, macrophages, and eosinophils. **Seven of these 10** patients (70%) had an abnormal UPSIT score. Of the 12 patients with a normosmia ,only 3 (25%) had an inflammatory response.

❖ There is a **loss of normal olfactory epithelial architecture** in patients with **CRS and hyposmia** compared with those patients with CRS and normosmia.

32 biopsy specimens in patients with **CRS and anosmia** have revealed an **atrophic and thin** olfactory epithelium.

KERN RC, CONLEY DB, HAINES GK 3RD, ET AL. PATHOLOGY OF THE OLFACTORY MUCOSA: IMPLICATIONS FOR THE TREATMENT OF OLFACTORY DYSFUNCTION. LARYNGOSCOPE 2004;114: 279–85

LEE SH, LIM HH, LEE HM, ET AL. OLFACTORY MUCOSAL FINDINGS IN PATIENTS WITH PERSISTENT ANOSMIA AFTER ENDOSCOPIC SINUS SURGERY. ANN OTOL RHINOL LARYNGOL 2000;109(8 PT 1):720–5

IMPACT OF ENDOSCOPIC SINUS SURGERY ON OLFACTION IN CHRONIC RHINOSINUSITIS

The outcomes vary widely, and olfactory improvement is unpredictable, ranging from roughly 5% to 85%.

In a study of 70 patients undergoing ESS, reported no significant differences in UPSIT or BTT scores before or at least 6 months after surgery, because only 6% of patients noted an improvement in their smell.

A 1996 study using the UPSIT showed that 52% of patients have an improvement in smell after surgery and 48% do not at an average of 18 months after surgery.

In a **long-term study of smell outcomes 5 years** after ESS, one study reported that 79% patients improved.


In evaluating patients based on polyp status with VAS they found that those with CRSWNP improved from 14.0 mm before surgery to 57.9 mm at 3 months, 59.1 mm at 6 months, 32.3 mm at 12 months, and 45.3 mm at 24 months.

Patients with CRSSNP had a higher preoperative score of 30.9 mm, which improved to 53.8 mm at 3 months, 54.4 mm at 6 months, 48.9 mm at 12 months, and 54.2 mm at 24 months.

Briner hr, jones n, simmen d. Olfaction after endoscopic sinus surgery: longterm results. Rhinology 2012;50(2):178-84.

DEGREE OF SMELL LOSS PREOPERATIVELY CAN PREDICT RECOVERY AFTER SURGERY

- ❖ Only anosmics have a significant improvement in olfaction after ESS in comparison with hyposmics .
- ❖ **Anosmics** significantly improved on the UPSIT from a preoperative mean of 9.7 to 21.3 6 months after surgery, and this improvement was sustained at 12 months after surgery.
- ❖ **Hyposmics** showed no significant change in the UPSIT scores from before surgery to 6 months or 12 months after surgery.



A second study also suggested that patients with anosmia may be more likely to benefit from ESS than those with hyposmia, but the difference in smell recovery between the two groups was not significant.

Using the UPSIT, 60.6% of anosmics improved compared with 42.4% of hyposmics.

PERIOPERATIVE CONSIDERATIONS FOR OLFACTORY PRESERVATION DURING ENDOSCOPIC SINUS SURGERY FOR CRS

- ❖ Several studies show that partial resection of the superior turbinate or removal of the middle turbinate does not have a negative impact on olfaction.
- ❖ The effect of partial resection of the **superior turbinate** on smell was studied . in 55 partial superior turbinate specimens, only 9 (16%) contained olfactory nerve fibers. Postoperatively, none of these 9 nostrils had a decrease in smell.

❖ Regarding **middle turbinates**, study found **no significant** difference in the postoperative change in UPSIT scores in 38 patients who had partial middle turbinate resection and 26 patients who did not as part of their ESS.

Friedman m, caldarelli dd, venkatesan tk, et al. Endoscopic sinus surgery with partial middle turbinate resection: effects on olfaction. Laryngoscope 1996; 106(8):977–81.

Multi-institutional study showed that patients who had bilateral middle turbinate resection were more likely to have worse CRS burden on CT and nasal endoscopy.

Patients with bilateral middle turbinate resection had a more significant improvement in smell identification test scores than those who had the middle turbinates preserved.

In these more severe CRS cases, removal of the likely degenerated middle turbinates potentially allowed better access for odorants to reach the olfactory cleft.

In contrary to these studies, other study found that, in revision sinus surgery, a history of middle turbinate resection was a negative prognostic indicator for smell improvement after surgery.

The results of these studies analyzing turbinate resection are inconsistent, middle turbinate resection may be considered when disease burden is high and the turbinates are degenerated.

If the middle turbinate is appears normal on endoscopy, **turbinate preservation is recommended.**

In evaluating olfaction after **olfactory cleft surgery**, either debulking of nasal polyps or removal of respiratory epithelial adenomatoid hamartomas can improve smell.

All patients with normosmia before olfactory cleft surgery conserved their sense of smell postoperatively.

patients with hyposmia or anosmia preoperatively, 45% had an improvement in smell and 55% had no change after surgery.

PERIOPERATIVE CONSIDERATIONS IN THE ENDONASAL APPROACH TO THE SKULL BASE

A study compared postoperative olfaction in patients who had **pituitary tumors** removed via the **transseptal** microscopic approach versus the **endoscopic endonasal** approach.

At 6 months after surgery, 13 of 25 patients had hyposmia and 5 of 25 patients had anosmia in the microscopic approach group.

None of the patients in the endoscopic approach group had smell dysfunction. This difference in smell recovery between the two groups was significant.

The use of a **cold knife** instead of **Monopolar cautery** when making the superior incision for harvest of the nasoseptal flap is close to the superior 1 cm of septal mucosa. The heat dispersion when using cautery may cause **unintentional damage** to the surrounding mucosa.

In a small cohort of 15 patients, reported that 0 of 8 patients had a worsened BTT with cold knife compared with 1 of 7 with monopolar cautery 3 months after surgery.

However, there was **no significant** reduction in olfactory tests in either of the groups.

Larger and long-term studies need to be conducted to confirm these results.

POSTOPERATIVE CONSIDERATIONS FOR SMELL LOSS

A study of 60 patients with CRSWNP + hyposmea were included in Iran 2012 showed that the placement **of triamcinolone-soaked gelfoam** into the olfactory cleft at the conclusion of ESS resulted in a greater chance for smell recovery than gelfoam alone 2 months after surgery.

Complete remission rate was 100% in the triamcinolone group and 76% in the control group.

SUMMARY

- ❖ **Preoperatively** discussing the potential for smell loss after endoscopic sinus or skull base surgery should be considered to address patient expectations and protect from future liability.
- ❖ **Intraoperatively**, surgeons should consider preserving the turbinates when they are not degenerated or significantly involved in the disease process. Carefully debulking olfactory cleft polyps may also be performed.
- ❖ During skull base reconstruction, care should be taken when harvesting the nasoseptal flap to preserve the superior 1 cm of mucosa.
- ❖ **After surgery**, there are currently no effective medications to improve anosmia other than standard medical therapy for CRS, which includes corticosteroids.