ORIGINAL CONTRIBUTION

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Patient-reported olfactory function following endoscopic sinus surgery with modified endoscopic Lothrop procedure / Draf 3*

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SUMMARY

Objectives/Hypothesis: *The Modified Endoscopic Lothrop procedure (MELP) or Draf 3 is a complex procedure, performed for chronic frontal sinusitis that is refractory to standard functional endoscopic sinus surgery. The procedure involves drilling of the frontal T (formed by the septum and middle turbinate's attachment to the skull base) onto the olfactory fossa often with exposure of the first olfactory neuron and may affect olfactory function. This study was performed to assess patients' subjective sense of smell following this procedure.* ***Study Design:*** *Prospective study of retrospective data.* ***Methods:*** *Sixty-eight patients, who underwent modified endoscopic Lothrop by the senior author (PJW) between 2003 and 2008, completed a post-operative questionnaire asking about their perception of olfactory function. All patients had their pre-operative subjective sense of smell documented prior to undergoing surgery. Patient records were reviewed for pertinent medical information such as the presence of asthma, aspirin sensitivity and nasal polyps.* ***Results:*** *This study found that the majority of patients reported improvement in their sense of smell post-operatively, while only a small number reported a negative impact on their smell. Thirty-nine patients reported an improvement in their post-operative smell grade. Twenty patients reported no change in their smell grade, while the remaining 9 patients stated that their sense of smell worsened after surgery. No statistically significant correlation was found between patient outcome and the presence of asthma, nasal polyps, or Samter's triad.* ***Conclusions:*** *The Modified endoscopic Lothrop procedure/Draf 3 had a positive effect on subjective sense of smell post-operatively in this cohort of patients.*

Key words: Modified endoscopic Lothrop, olfaction, frontal sinus drillout, olfactory function, smell

INTRODUCTION

The Modified Endoscopic Lothrop procedure (MELP)/Draf 3 or frontal sinus drillout is often used when endoscopic sinus surgery (ESS) fails to address symptoms of chronic frontal sinusitis [(1)]. The procedure aims to create the largest possible combined frontal sinus ostium by removing the upper portion of the nasal septum, the floor of the frontal sinus, and the intersinus septum. Other indications for the MELP are neo-osteogenesis in the frontal recess/frontal ostium, frontal recess adhesions, frontal sinus mucoceles, disease processes with resultant loss of the posterior wall or floor of the frontal sinus, failed previous osteoplastic flap with obliteration, and tumor removal from the frontal sinus [(2)]. In most patients MELP is performed in conjuncture with revision ESS to address the inflammatory changes in these sinuses.

The distribution of human olfactory neuroepithelium may vary from patient to patient. There is general agreement that it is located high in the nasal cavity, and includes the superior nasal septum, the cribriform plate, superior turbinate, and superior-lateral nasal wall [(3)]. Leopold et al. used an electro-olfactogram and anatomically located biopsy specimens to examine the distribution of the olfactory neuroepithelium in 12 healthy, trained volunteers. Their results found functioning olfactory neuroepithelium on the medial region of the middle turbinate, around its anterior insertion and on the superior septum. This

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Table 1. How would you rate your CURRENT sense of smell?

	Description of smell function
1	Normal Smell
2	Mild loss of small
3	Moderate loss of smell
4	Severe loss of smell
5	No smell at all

Table 2. Comparison between contactable and uncontactable patients.

	Mean preoperative smell score	Polyps	Asthma	Samters
Contactable	4.0	73%	53%	12%
Not contactable	3.8	76%	40%	8%
p		0.78	0.45	0.53

Table 3. The presence of polyps, asthma and Samter's triad in all patients.

	Number	Age (mean)	Follow-up months	Polyps	Asthma	Samters
Improved	39 (57%)	56.5	35.4	26	22	7
Same	20 (29%)	58.3	30.3	17	10	0
Worse	9 (13%)	64.5	48.3	7	4	1

was more anterior in the nasal cavity than previously thought. These areas are approached surgically during the MELP and may theoretically be disturbed resulting in a change in olfactory perception.

To our knowledge there have been no studies to date that look at the effect of the MELP on olfactory function. This study aims to investigate the change in olfactory function after MELP, as perceived by the patients themselves.

MATERIALS AND METHODS

Patients

All patients who underwent a MELP by the senior author (PJW) between 2003 and 2008 were studied after local institutional ethics review board approval was obtained. Indication for surgery was chronic rhinosinusitis that had failed prior ESS and continued to be symptomatic despite maximal medical therapy which included nasal steroid spray, saline irrigations, long term antibiotic and oral prednisone bursts. Only those patients who had their pre-operative sense of smell recorded on a scale of 1 to 5, during their initial consultation were included (Table 1). Charts were reviewed for pertinent medical information including the presence of asthma, aspirin sensitivity and nasal polyps.

Interview

Patients were contacted and informed consent was obtained for a telephone interview. During the telephone interview, patients were asked to grade their sense of smell using the same scale (Table 1) used during the initial consultation. Each patient was asked two questions: 1) How would you rate your current sense of smell, 2) Does your sense of smell fluctuate? (if yes, on its own or with treatment).

Statistical analysis

Data was analyzed using Fischer exact test and Mann Whitney test. P values < 0.05 were considered statistically significant.

RESULTS

One hundred and ten patients underwent a modified Lothrop procedure by one senior author (PJW) between the years 2003 and 2008. Of those patients, 68 (37 males and 31 female), had preoperative smell documented and completed the postoperative smell interview. Ten patients did not have preoperative smell documented, and 32 patients could not be contacted for postoperative questioning. Comparisons between patients who were contactable and the ones who were not contactable are shown in Table 2; all p values were insignificant. The patients ranged in age from 19 - 79 years (average 58.1). The average length of follow-up was 35.6 months (ranging from 6 - 60 months). Nasal polyposis was found in 50 of the patients (73%), asthma in 36 (53%) and Samter's triad in 8 (12%) (Table 3). On average the preoperative smell grade was 4 (median 5) and postoperatively, the average improved to a grade 3 (median 3) (Figure 1). This was found to be statistically significant with a p value < 0.0001. When the patients were asked if their smell fluctuated, 34 (50%) reported no fluctuations, 25 (37%) reported fluctuations without any change in treatment and 9 (13%) reported fluctuations with antibiotics or oral prednisolone.

The patients were further grouped into those whose smell improved ($n = 39$), stayed the same ($n = 20$) and worsened ($n = 9$) after surgery (Table 3). There was no statistical relation ($p > 0.05$) between outcome and those patients with polyps, asthma or Samter's triad (Figure 2). The mean preoperative grade for those patients whose smell improved, stayed the same and worsened was 4.5, 3.8 and 2, respectively. In those patients whose smell improved the mean postoperative grade was 2.5 ($p < 0.001$) (Figure 3). In the 9 patients whose smell decreased the mean postoperative grade was 3.4 ($p < 0.002$) (Figure 4). Polyps were present in 67% of patients whose smell improved postoperatively and in 78% of patients whose smell worsened. This suggests that polyps may predict which patients are likely to have an improvement in smell after this procedure.

DISCUSSION

This is the first study to our knowledge that evaluated the effect that the MELP has on postoperative smell function. The majority of patients in this study reported an improvement in their sense of smell and only a small number reported a negative effect on smell function. We found a statistically signifi-

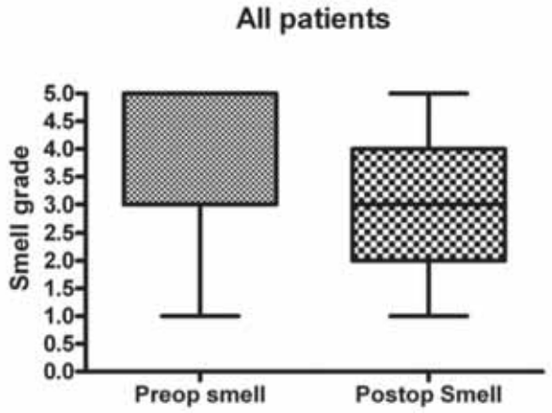

Figure 1. Pre and post-operative smell function in all patients who underwent MELP.

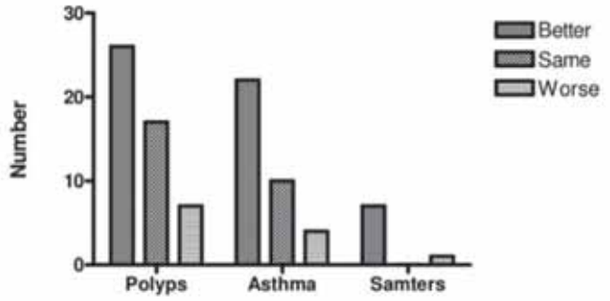

Figure 2. The effect of polyps, asthma and the presence of Samter's triad on smell function after surgery.

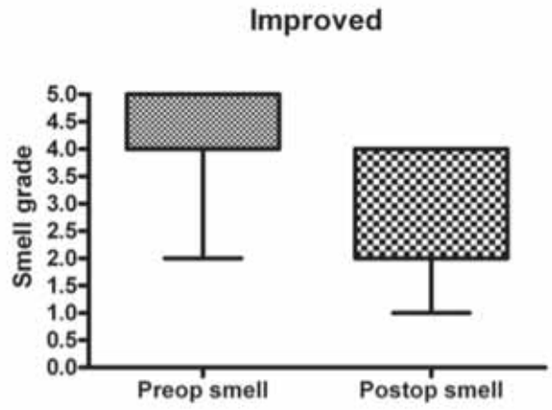

Figure 3. Pre and postoperative smell grade in those patients whose smell improved after MELP.

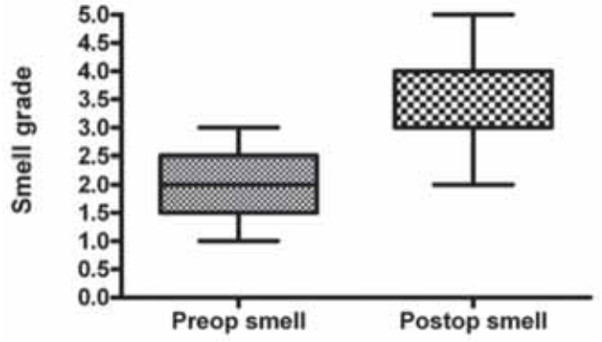

Figure 4. Pre and postoperative smell grade in those patients whose smell declined after MELP.

cant improvement in the average smell grade of the 68 patients studied (p value < 0.0001). Thirty-nine patients (57.3%) reported improvements in the post-operative smell grade with the average grade improving from 4.5 to 2.5 ($p < 0.001$).

Olfactory dysfunction is a common symptom of CRS and a known but infrequent complication of ESS. Patients who suffer from hyposmia or anosmia display less interest in eating and report a negative effect on their overall quality of life. If there is complete anosmia some describe alterations in their activities of daily living and/or psychological well-being as a result of the inability to identify potentially dangerous smells (i.e. gas leak). If we compare the improvement in olfaction after MELP in 57% of patients to the literature this result is similar to that achieved with standard ESS. Studies have shown that 50 to 83% of patients may notice an improvement in olfactory function after ESS [4-7]. The wide range of improvement in the literature may be secondary to several factors: the use of different measurement methods, timing of olfactory testing and severity of sinus disease in the patients studied. Delank et al. found that patients with mild polypoid disease with complaints of of hyposmia benefitted the most from ESS [4]. This is different from our study, which found no significant correlation between the presence of polyps and improvement in olfaction post-operatively. However, we study a very select cohort of patients who all had severe sinus disease, which necessitated revision ESS along with a MELP. Jiang et al. [8] studied a group of patients who had severe CRS and smell loss and concluded that ESS has little impact on the ability to smell. These findings were thought to reflect the severe nature of the initial olfactory deficit. It is assumed that there may be a greater number of and more extensive respiratory mucosal patches within the olfactory area in patients who continue to be anosmic despite optimal surgical management [9] Although we did not look at the excised tissue for olfactory epithelium in this study it may be warranted in future studies.

In our patients, the average initial olfactory deficit was severe, with an average preoperative smell grade of 4. Although the MELP opens both frontal sinuses widely, the posterior landmark of the frontal sinus dissection is the first olfactory neuron and therefore the procedure should cause little direct damage to the olfactory fossae. The olfactory neurons and the cribriform plate lie just medial to the frontal recess, and patients who undergo MELP often have disease reaching into the olfactory recess. Therefore, it is likely that the improvement in

smell is due to improvement in the obstruction and inflammation around this region, as a result of the procedure. However, all MELP patients in this study also had a full ESS at the same time, which may contribute to the improvement in olfaction post-operatively. On the other hand, 9% of the patients reported a decrease in their sense of smell after surgery. It is unclear why some patients reported a decrease in their sense of smell. However, as mentioned earlier the exact location of the olfactory epithelium and distribution may be varied and in theory could be disturbed during the MELP.

A major limitation of this study is the lack of an objective measure of olfaction (pre- and postoperatively) for all patients. Also, previous studies have demonstrated a poor correlation between subjective and objective assessments of olfactory function [10,11], although Welge-Luessen et al. [12] did find a moderate correlation. The authors recognize the aforementioned as limitations, but feel that the findings of this study are still of interest as they form a useful basis for a larger follow-up study to prospectively evaluate a larger group of patients undergoing the MELP using validated smell tests.

CONCLUSIONS

Prior to this study it was unclear whether this combined ESS and MELP surgery had a negative or positive outcome on the patients' sense of smell. We found that the MELP in combination with ESS had a positive effect on patient reported postoperative smell function, with the majority of patients reporting an improvement in their smell.

REFERENCES

1. Gross WE, Gross CW, Becker D, Moore D, Phillips D. Modified transnasal endoscopic Lothrop procedure as an alternative to frontal sinus obliteration. Otolaryngology - Head and Neck Surgery. 1995; 113: 427-434.
2. Wormald PJ. Extended Approaches to the Frontal Sinus: The Modified Endoscopic Lothrop Procedure. In: Bumpert E, ed. Endoscopic Sinus Surgery. New York: Thieme Medical Publishers Inc, 2008: 115-132.
3. Leopold DA, Hummel T, Schwob JE, Hong SC, Knecht M, Kobal G. Anterior Distribution of Human Olfactory Epithelium. Laryngoscope. 2000; 110: 417-421.
4. Delank KW, Stoll W. Olfactory Function after Functional Endoscopic Sinus Surgery for Chronic Sinusitis. Rhinology. 1998; 36: 15-19.
5. Eichel BS. Improvement of Olfaction Following Pansinus Surgery. ENT Journal. 1994; 73: 248-253.
6. Downey LL, Jacobs JB, Lebowitz RA. Anosmia and Chronic Sinus Disease. Otolaryngology - Head and Neck Surgery. 1996; 115: 24-28.
7. Seiden AM, Smith DV. Endoscopic intranasal surgery as an approach to restoring olfactory function. Chem Senses. 1988; 13: 736.
8. Jiang RS, Lu FJ, Liang KL, et al. Olfactory Function in Patients with Chronic Rhinosinusitis Before and After Functional Endoscopic Sinus Surgery. Am J Rhinology. 2008; 22: 445-448.
9. Lim HH, Park HJ, Lee HM, Choi JO. Olfactory Mucosal Findings in Patients with Persistent Anosmia after Endoscopic Sinus Surgery. Ann Otol Rhinol Laryngol. 2000; 109: 720-725.
10. Knaapila A, Tuorila H, Kyvik K, et al. Self-ratings of olfactory function reflect odor annoyance rather than olfactory acuity. Laryngoscope. 2008; 118: 2212-2217.
11. Landis BN, Hummel T, Hugentobler M, Giger R, Lacroix JS. Ratings of overall olfactory function. Chem sens. 2003; 28: 691-694.
12. Welge-Luessen A, Hummel T, Stojan T, Wolfensberger M. What is the Correlation Between Ratings and Measures of Olfactory Function in Patients with Olfactory Loss? Am J Rhinology. 2005; 19: 567-571.

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