

## Short Communication

# Reconsideration of Chronic Rhinosinusitis Surgery from a Different Point of View: Functional Nasalization

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**Abstract**

Functional endoscopic sinus surgery techniques show variability. Maximum widening of the sinus ostia is preferred particularly for some patients with polyposis in order to prevent recurrences however this results in the problem of "nasalization". Development of minimally invasive techniques to avoid from anatomic nasalization, new evidence shows that nasalization resulting from functional endoscopic sinus surgery may arise not only as an anatomic but also a functional phenomenon. In this short communication we wanted to discuss the nasalization of paranasal sinuses after endoscopic sinus surgery. Nasalization is divided into two as anatomic and functional. Functional nasalization means that joining of paranasal sinuses to nasal respiration. In this short communication we discussed this subject with our studies and publications in literature.

Over time, functional endoscopic sinus surgery (FESS) has gone through an evolution giving rise to a number of modifications. Although maximum possible widening of the ostio-meatal complex and sinus ostia were considered to be a prerequisite for successful FESS initially, the width of the sinus ostia varied according to the extent of the disease and minimally invasive procedures were developed [1]. On the other hand, although maximum widening of the sinus ostia is preferred particularly for patients with polyposis in order to prevent recurrences [2], this results in the problem of nasalization. Jankowski described nasalization as the widening of the frontal ostium in conjunction with middle concha resection as well as radical ethmoidectomy, antrostomy (wide middle meatal ostiotomy), and sphenoidotomy [3]. In that method, maximum possible resection of the ethmoid mucosa is performed, while the disease free mucosa of the other major sinuses is left untouched. This also allows endonasal access to sinus due to the widening of the ostia of the large paranasal sinuses. Draft [4] described a 3-stage widening for the frontal sinus ostium. Nasalization resulting from the abovementioned surgical techniques for chronic sinusitis may also termed as anatomic nasalization.

Despite the recent development of minimally invasive techniques to avoid from anatomic nasalization, new evidence suggests that nasalization resulting from FESS may arise not only as an anatomic but also a functional phenomenon. A sound understanding on nasalization requires consideration

of the normal physiology of the intact nasal cavity and sinuses throughout a respiratory cycle, and under normal conditions, paranasal sinuses do not accompany the inspiration and expiration, although in forced inspiration and expiration partial attendance may be observed. In a study by Möller et al., [5] involving normal healthy individuals, the ventilation of the maxillary and frontal sinuses could be visualized by gamma camera imaging during pulsating airflow. In addition, using pulsating airflow, between 3% and 5% of nasally deposited aerosols penetrated into the paranasal sinuses while during application without pulsation aerosol deposition was below 1%. These observations confirm our understanding that only a very weak relationship exists between nasal respiration and paranasal sinus aeration. However, FESS surgery, whether traditional or minimally invasive, alters the aeration within the sinuses that is normally unrelated to nasal airflow, and sinuses become prone to the effects of normal nasal airflow. This is referred to as functional nasalization. Accordingly, Frank DO et al., [6] compared the effect of FESS on the maxillary sinus airflow in 4 patients with chronic sinusitis using computational fluid dynamics method found a 4-fold increase in basal, i.e. preoperative maxillary sinus airflow, after surgery. Also, FESS with uncinctomy alone, without maxillary sinus ostium dilation rendered the maxillary sinus prone to the nasal airflow both in our study [7] and in the study by Zhu JH et al., [8]. On the other hand, examining the effect of the middle meatal antrostomy on nitric oxide within the maxillary sinus with computational fluid

dynamics, Chung SK and colleagues [9] found significant air entry into the sinus during nasal inspiration and expiration, with a decline in sinus NO of 54% and 30% at the end of the inspiratory phase and at the expiration phase, respectively.

In the light of these data, two questions should be asked. The first question refers to the muco-ciliary function after FESS, and second relates to the failure of the hypertrophic-hyperplastic edematous sinus mucosa to transform into normal mucosa. Perhaps, studies directly looking into these questions may provide certain answers [10]. However, at this stage, we hold the view that the muco-ciliary and mucosal recovery are probably influenced by the functional nasalization, which may be assumed to result in a new state of sinus physiology owing to air turbulence within the sinus and also owing to the alterations in the gaseous content such as that occurring with nitric oxide.

Mantoni et al., examined the coronal CT of 30 patients with chronic sinusitis and 12 patients with nasal polyps before and 12 months after FESS and found an increase in the ostiomeatal complex opening from 42% to 83% and from 8% to 45% in those with sinusitis or polyps, respectively [11]. Despite a symptomatic improvement in 91% of the patients, sinus mucosa opacification remained almost unchanged.

This observation, in addition to showing that mucosal disease is irreversible in chronic sinusitis, also may represent an indirect and significant sign of functional nasalization [10]. As a result of uncinectomy with or without ostial widening, the diseased sinus mucosa is directly exposed to the ambient air without being warmed, filtered, and humidified. The continued sinus mucosa reaction to the irritants and allergens in the respiratory air may prevent a mucosal improvement. These results suggest that pressure alterations due to functional nasalization may contribute to the persistence of mucosal thickening.

The most significant factor in the development of functional nasalization is obviously the resection of the uncinuate process [7,9]. Studies have indicated that the uncinuate process acts as a barrier for the maxillary sinus and also against the development of functional nasalization. Therefore, unless absolutely required, it is recommended that the uncinuate process is left intact.

In conclusion, although FESS for surgical treatment of chronic

sinusitis is associated with symptomatic improvements, it also results in the development of a new physiological status within the sinus due to functional nasalization. Therefore, we should either search for new therapeutic concepts or be more reluctant in making a decision for FESS surgery.

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