Preventing Lateral Synechia Formation After Endoscopic Sinus Surgery With a Silastic Sheet

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Objectives: To investigate whether the insertion of a Silastic sheet between the middle turbinate and lateral nasal wall can prevent lateral synechia formation when an unstable, floppy middle turbinate results from endoscopic sinus surgery (ESS).

Design: Prospective study.

Setting: University hospital.

Patients: Thirty patients who developed an unstable, floppy middle turbinate during ESS were allocated in order of occurrence as follows: group 1, 15 patients, 17 sides including 2 bilateral cases; group 2, 15 patients, 18 sides including 3 bilateral cases.

Interventions: In group 1, a fan-shaped Silastic sheet was inserted between the middle turbinate and lateral nasal wall and secured to the caudal septum. In group 2, no specific procedure was performed except for meticulous postoperative care to prevent lateralization of the middle turbinate.

Main Outcome Measure: We observed the patients for 5 months and compared the occurrence rate of synechia formation between the 2 groups.

Results: Synechiae developed in 1 of 17 sides (6%) in group 1 and 8 of 18 sides (44%) in group 2, for success rates of 94% and 56%, respectively. The success rates differed significantly. The middle turbinate was preserved in all patients in group 1.

Conclusion: The results of this study suggest that the insertion of a Silastic sheet in the middle meatus is a useful method for preventing lateral synechia formation and for preserving the middle turbinate.

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LATERALIZATION OF THE MIDDLE turbinate with scarring and obstruction of the middle meatus are the most common complications of endoscopic sinus surgery (ESS). An unstable, floppy middle turbinate occurs frequently, which can make meticulous postoperative dressing difficult during sinus healing. Consequently, the risk of synechia formation and the recurrence of sinusitis increase, necessitating further surgery.

Instability of the middle turbinate may result from excessive excision of the basal lamella or removal of the horizontal bony portion of the middle turbinate; from a lateral fracture of the middle turbinate to access the sphenoethmoidal recess or natural ostium of the sphenoid sinus; or from severe polyposis of the middle turbinate and superior meatus region necessitating wide trimming with a microdebrider. A congenitally weak and thin middle turbinate; a concha bullosa, which needs partial resection; and a paradoxical middle turbinate may also contribute to the instability of the middle turbinate after ESS.

Although different methods have been attempted to prevent lateral synechia formation after ESS, each procedure involves some disadvantages or difficulties, and no standard measure has been proposed. This study evaluated the efficacy of inserting a Silastic sheet (Dow Corning, Midland, Michigan) between the middle turbinate and lateral nasal wall, which is a relatively simple procedure to perform, for preventing lateral synechia formation when an unstable, floppy middle turbinate occurs during ESS.

METHODS

PATIENTS

Thirty patients (35 sides, including 5 bilateral cases) who developed an unstable, floppy middle turbinate during ESS were enrolled in this prospective study. These patients underwent ESS to treat persistent chronic rhinosinusitis or nasal...
polyposis that was resistant to medical therapy (antibiotics, mucolytics, and topical or systemic steroids). Patients who had previous ESS or polypectomy were excluded from the study.

Patients were assigned into 2 groups of 15 patients each in order of occurrence of unstable, floppy middle turbinates. All of the patients underwent bilateral ESS, and nasal polyps were present in 18 patients. The extent of the surgical procedures was determined according to the involved sinuses and included bilateral uncinection, anterior and posterior ethmoidectomy, and middle meatal antrostomy; frontal sinusotomy, sphenoidotomy, and middle turbinoplasty when indicated; and polypectomy in patients with accompanying nasal polyps. Septoplasty and inferior turbinoplasty were combined with ESS as indicated. We tried not to damage the lateral surface of the middle turbinate during the operation, and percentage of cases that involved trimming with the microdebrider (patient with a polyoid or hypertrophic middle turbinate) or partial lateral resection of the middle turbinate (patient with a concha bullosa) and the extent of the procedures was similar in both groups. The causes and proportions of the development of an unstable, floppy middle turbinate are listed in Table 1. The male-female ratios and mean patient ages were 10:5 and 37.4 years in group 1 and 9:6 and 39.6 years in group 2, respectively.

We explained to the patients the possibility of synechia formation when an unstable, floppy middle turbinate developed and the consequent need for additional surgery, such as division of the synechia or partial resection of the middle turbinate. Informed consent was obtained from all patients and the study was approved by the institutional review board of the College of Medicine, Soonchunhyang University.

**SURGICAL TECHNIQUES, FOLLOW-UP, AND ASSESSMENT**

All surgical procedures were performed by the same surgeon (J.Y.L.) under general anesthesia. In group 1, when a floppy middle turbinate occurred, a soft, pliable, 0.03-inch-thick polymeric Silastic sheet was shaped and placed in the nasal cavity between the middle turbinate and lateral nasal wall. The fan-shaped Silastic sheet (Figure 1) was of sufficient size to cover the middle turbinate about 1.5 to 2.0 cm from the caudal margin (Figure 2). The Silastic sheet was measured and placed in the middle meatus under the direct vision of a straight, 4-mm, 0° endoscope (Karl Storz GmbH & Co KG, Tuttingen, Germany). Then, the Silastic sheet was secured to the caudal portion of the nasal septum using a through-and-through mattress suture with 4-0 chromic catgut (Ethicon Inc, Somerville, New Jersey). This procedure provides adherence of the Silastic sheet to the septum, while leaving sufficient space to allow the patient to breathe comfortably through the nose (Figure 3). The Silastic sheet was easily removed in the office with biting forceps after cutting the suture with conchotomy scissors or a blade 10 to 14 days later, depending on the mucosal condition and healing process (Figure 4).

In group 2, we did not use any special material to help prevent synechia formation nor perform other procedures except for meticulous dressing to prevent lateralization of the middle turbinate during the postoperative healing period. The nasal packing was removed 2 days postoperatively, and the patient was discharged the next day. After surgery, we prescribed a single daily 20-mg dose of prednisolone for 7 days. Antibiotics, mucolytics, and topical steroid spray were also prescribed for 4 to 6 weeks after the operation. The patients were educated on the method of saline irrigation. Each patient visited our office twice a week for 2 weeks, then once a week for 4 weeks, and finally once a month for up to 5 months. Meticulous endoscopic dressing and saline irrigation were performed until the cavity was healed.

After the Silastic sheet had been removed from the group 1 patients, 1 of us (S.W.L.), blinded to whether a Silastic sheet had been used, simultaneously evaluated the postoperative results and monitored the endoscopic findings in both groups during the follow-up period. When both physicians agreed that there was no synechia formation in the middle meatus, the case was regarded as a surgical success.

### Table 1. Causes of Unstable, Floppy Middle Turbinates (MTs) in Groups 1 and 2

<table>
<thead>
<tr>
<th>Cause</th>
<th>Patients, No. (%)</th>
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<tbody>
<tr>
<td>Group 1 (n = 17)</td>
<td>Group 2 (n = 18)</td>
</tr>
<tr>
<td>Congenitally weak and thin MT</td>
<td>7 (41)</td>
</tr>
<tr>
<td>Concha bullosa, requiring partial lateral</td>
<td>4 (23)</td>
</tr>
<tr>
<td>resection of MT</td>
<td></td>
</tr>
<tr>
<td>Incidental removal of horizontal portion of MT</td>
<td>2 (12)</td>
</tr>
<tr>
<td>Severe polyoid change of MT, requiring</td>
<td>2 (12)</td>
</tr>
<tr>
<td>wide trimming</td>
<td></td>
</tr>
<tr>
<td>Lateral fracture of MT to access the</td>
<td>1 (6)</td>
</tr>
<tr>
<td>superior meatus, sphenoidethmoidal recess,</td>
<td></td>
</tr>
<tr>
<td>or sphenoid ostium</td>
<td></td>
</tr>
<tr>
<td>Medialization of MT owing to narrow</td>
<td>1 (6)</td>
</tr>
<tr>
<td>middle meatus</td>
<td></td>
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</tbody>
</table>

![Figure 1. Design of the fan-shaped Silastic sheet (Dow Corning, Midland, Michigan).](image1)

![Figure 2. Endoscopic view of a Silastic sheet (Dow Corning, Midland, Michigan) in a patient who underwent the operation 5 days earlier.](image2)

- A. Mucosal injury on the surface of the lateral nasal wall (hollow arrow) and a thinned and weakened root area of the middle turbinate (MT) (white arrow) are noted. The superior margin of the Silastic sheet does not contact the mucosal surface of the MT dome. B. The posterior portion of the Silastic sheet does not contact the anterior margin of the horizontal portion of the MT or the ethmoid cavity.
Many methods have been proposed to prevent synchiae and to handle the unstable middle turbinate. Friedman et al.3 recommended middle turbinate medialization by inducing a controlled synchiae between the caudal end of the middle turbinate and the septum using microdebrider-assisted mucosal abrasion. However, this method may compromise airflow to the olfactory neuroepithelium and can affect the sense of smell. In addition, controlled synchiae might not be created, leading to lateralization of the middle turbinate. Thornton4 introduced the suture stabilization technique of the middle turbinate. Although this method may effectively prevent synchiae, the suture technique is difficult to perform in a narrow posterior nasal cavity, and it is also difficult to pass a needle through the solid bone of the middle turbinates and ethmoid plate, especially when a septoplasty has not been performed. Placing a Silastic sheet with an inverted U-shape in the ethmoid cavity or a middle meatal stent also has been tried.5 However, the Silastic sheet is easily displaced during the follow-up period, and fixing the Silastic sheet with ethmoid packing over a prolonged period might induce infection or even fatal toxic shock syndrome. Partial resection of the middle turbinate also has been performed, but this method does not completely eliminate the possibility of a synchiae. The superior aspect of the turbinate, which is often preserved, may lateralize and cause iatrogenic frontal sinus obliteration.6 In addition, this would increase the healing period and might alter the normal nasal physiologic structure, especially when the middle turbinate is totally resected. Recently, platelet gel packing and sodium hyaluronate–carboxymethylcellulose (HA-CMC), which

The most common complication of ESS, occurring in as many as 43% of patients, is lateralization of the middle turbinate.1,2 The formation of scar tissue between the middle turbinate and lateral nasal wall can obstruct the outflow of the ethmoid, maxillary, and frontal sinuses, leading to recurrent symptoms and necessitating attempts of synchiae division in the office or further surgery. Proper handling of the middle turbinate and the prevention of lateralization appear to be the keys to avoiding postoperative problems and ensuring a successful outcome for the patient undergoing ESS.

In group 1, a synchiae developed on 1 of 17 sides (6%), for a success rate of 94%. The synchiae was found within 2 months of the procedure, and complete obstruction of the middle meatus did not occur. Along the upper third to half of the middle turbinate, scar tissue formed and attached to the lateral nasal wall. It was not difficult to perform postoperative sinus care through the remaining space, and the synchiae was divided 3 months postoperatively. In 2 patients, focal synchiae were found between the middle turbinate and nasal septum after the Silastic sheet was removed, although the patients did not complain of any olfactory symptoms.

In group 2, synchiae formed on 8 of 18 sides (44%), for a success rate of 56%. Five sides developed partial synchiae, as with the patient in group 1, while 3 sides developed total obstruction of the middle meatus. These patients underwent division of the synchiae or partial or near-total resection of the middle turbinate and revision polypectomy when polyps recurred 3 to 4 months after the initial operation.

No synchiae recurrence took place in a patient in group 1, while 3 patients in group 2 developed partial synchiae formation after the second procedure. The rate of lateral synchiae formation was significantly lower in group 1 (P = .02) (Table 2). Additional lateral synchiae formation did not occur in any patient during the follow-up period of 5 months.

Table 2. Comparison of Synchiae Formation Rate Between Groups 1 and 2

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group 1</th>
<th>Group 2</th>
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<tbody>
<tr>
<td>Patients, No. (sides)</td>
<td>15 (17)</td>
<td>15 (18)</td>
</tr>
<tr>
<td>Occurrence of synchiae, sides</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Synchiae formation rate, %</td>
<td>6a</td>
<td>44</td>
</tr>
</tbody>
</table>

*aStatistically significant (P < .02).* 

STATISTICAL ANALYSIS

The synchiae formation rates in groups 1 and 2 were compared with the χ² test using SPSS Software, version 11.0 (Chicago, Illinois). A P value of less than .05 was considered statistically significant.
prevent adhesions, have been used, but the efficacy of these materials remains unclear.\textsuperscript{7,10} Compared with the method described by Thornton,\textsuperscript{4} our technique is relatively simple to perform because fixation of the Silastic sheet is generally performed at the anterior to middle portion of septal cartilage. Our procedures also provide little difficulty in the postoperative care of the ethmoid sinus and frontal recess area, compared with inserting an inverted U-shaped Silastic sheet. A synchiae between the middle turbinate and septum rarely occurs, unless mucosal injury occurs at the same location between the 2 structures, which would result in little possibility of olfactory disturbance. In addition, the cost to the patient is reduced because our method does not require materials such as platelet gel packing or HA-CMC.

The key to our method is using a Silastic sheet of the proper size. If the height of the Silastic sheet is excessive, it may induce irritation and mucosal injury to the root and dome of the middle turbinate during packing or postoperative dressing, while if the Silastic sheet is too long, it may induce mucosal injury or bleeding at the horizontal portion of the middle turbinate or entrance of the ethmoid sinus. Conversely, a Silastic sheet that is too small may be displaced or extruded from the middle meatus during packing removal or postoperative care at the office. Therefore, the size of the Silastic sheet is the most important factor in our technique. In addition, a floppy middle turbinate has a generally weak nature, thus a Silastic sheet of 0.03-inch thickness provides sufficient strength to prevent the lateralization of the middle turbinate during the healing period. Crust and synchiae formation between injured mucosa usually occurs in the first 10 to 14 days after surgery. A Silastic sheet can effectively prevent these events by serving as a barrier between the middle turbinate and lateral nasal wall.

This method also can be helpful when septoplasty and turbinate surgery are combined with ESS. The Silastic sheet can also prevent synchiae formation between the septum and inferior turbinate. If septal mucosal injury occurs during the septoplasty, it can accelerate the healing process by moistening and humidifying the injured site and by avoiding possible trauma during postoperative care. When insertion of the Silastic sheet was combined with turbinate surgery, some patients complained of nasal obstruction due to crusting formation and nasal discharge; however, this could be relieved with saline irrigation and meticulous postoperative care. Crusting at the suture site can also be prevented by applying an ointment or emollient.

The middle turbinate is an important surgical landmark in primary or revision ESS and contributes to the normal nasal physiologic structure.\textsuperscript{1,11} Therefore, it should be preserved as much as possible. We were able to preserve the middle turbinate in all of our patients using our Silastic sheet method.

In conclusion, we achieved a favorable success rate with the insertion of a Silastic sheet between the middle turbinate and lateral nasal wall in cases in which an unstable, floppy middle turbinate occurred. Moreover, the middle turbinate, an important surgical landmark contributing to normal nasal physiologic structure, was preserved in all cases. We present this technique as a useful, effective measure for preventing lateral synchiae formation in ESS. However, we emphasize that our method is not a substitute for a meticulous surgical technique in an attempt to avoid causing an unstable, floppy middle turbinate.

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\textbf{REFERENCES}


