Endoscopic Orbital Decompression for Dysthyroid Orbitopathy

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ABSTRACT
Since 1957, when Walsh and Ogura introduced transantral orbital decompression, various surgical approaches have been introduced for the treatment of dysthyroid orbitopathy. With the development of endoscopic sinus surgery, orbital decompression can now be approached transnasally by endoscope alone. We reviewed the medical records of 10 patients who had received endoscopic orbital decompression. Of the 10 patients, four eyes from three patients were managed for decreased visual acuity, while 13 eyes from seven patients were managed for exophthalmos. Three patients who had initially complained of decreased vision demonstrated eventual improvement. An initial mean proptosis of 19.3 mm decreased to 16.5 mm. Six eyes with abnormal color vision were resolved after the decompression. Four patients with diplopia complained of continued diplopia after the decompression and were managed with extraocular muscle surgery or prism glasses. Compared to the conventional transantral approach, endoscopic orbital decompression features less morbidity and comparable ophthalmic results.

KEY WORDS
- Endoscopic orbital decompression
- Dysthyroid orbitopathy.

INTRODUCTION
Graves’ disease most often accompanies orbital symptoms occurring bilaterally. The disease occurs frequently in people in their 20s and 30s and more often in women than in men. The exophthalmos associated with Graves’ disease is reportedly due to an autoimmune process and bears little relation to the degree of the thyroid abnormalities. Therefore, even when the hyperthyroidism is treated, the orbital symptom is not eliminated, which makes treatment difficult.1) Only 5% of exophthalmos patients require medical treatment for decreased vision,2) which is caused by optic nerve compression or exposure keratitis.

Surgical and nonsurgical therapies have been used to prevent visual loss. Among them, the orbital decompression approach, an operative method, has been widely used since its introduction by Walsh and Ogura in 1957.3) They performed a two-wall inferior and medial decompression through a Caldwell-Luc maxillary antrostomy.

Another method, the transorbital approach introduced by Anderson et al.,4) has not been widely used. More recently Trokel et al.,5) introduced the orbital fat removal through a subciliary incision. With the advent of intranasal endoscope, Kennedy et al., introduced transnasal approach for medial and inferior orbital wall decompression, avoiding Caldwell-Luc approach.6)

For the last three years, we have been applying, through nasal endoscopy, the orbital decompression approach on patients with exophthalmos caused by thyroid gland dysfunction. This report is our analysis of the medical records and includes the procedure and results of the surgery.

MATERIALS AND METHODS

Subjects
The subject pool comprised 17 eyes of 10 patients with thyroid gland dysfunction, which was treated with endoscopic orbital decompression in the otorhinolaryngology department of Samsung Medical Center from January 1995 to October 1998. Medical records were analyzed in the retrospective method. The patients consisted of three males and seven females, with the patients’ ages ranging from 27 to 74 years (average age of 43.3). The chief complaints of the patients consisted of decreased vision (four eyes in three patients) and exophthalmos...
(13 eyes in seven patients). One patient had exposure keratitis in both eyes before surgery. Color vision abnormality was found in six eyes, and extraocular muscle abnormality was found in nine eyes. At the time of surgery, eight patients were euthyroid while two were hypothyroid.

Eyesight before and after surgery was evaluated relative to corrected visual acuity, and the degree of exophthalmos was measured in millimeters with a Hetelexophthalmometer. Color vision was tested with an Ishihara color vision test. Before treatment, the degree of exophthalmos in the 17 eyes ranged from 13 mm to 24 mm and averaged 19.0 mm. The mean visual acuity ranged from 0.03 to 1.5 with a mean of 0.69.

Surgical technique

Seven patients underwent surgery on both eyes on the same day while three patients were treated with orbital decompression on one eye only. Under general anesthesia, the patient is placed in a supine position with the head tilted up approximately 30 degrees. The mucosa in the nasal cavity is packed with a cotton pledget containing lidocaine and epinephrine, and an infiltration anesthesia mixed with 1% lidocaine and 1/100,000 epinephrine is applied to the same area as of endoscopic sinus surgery. Following the removal of the uncinate process, a complete ethmoidectomy is conducted. The fovea ethmoidalis and the lamina papyracea are exposed in the upward and lateral direction, respectively. The maxillary ostium should be generously enlarged to provide optimal exposure of the orbital floor. Bone is removed in a posterior direction to the level of the back wall of the sinus. Anterior removal stops at the thick bone of the frontal process of the maxilla, which protects the nasolacrimal duct. The skeletonized lamina papyracea is gently penetrated with a small spoon curette. The bony fragments of the lamina papyracea are lifted in a medial direction. Bone of the lamina papyracea is removed in a superior direction to the level of the ethmoid roof. As dissection continues in a posterior direction toward orbital apex, the annulus of Zinn is encountered, representing the posterior limit of dissection. The infraorbital nerve is identified laterally within the maxillary sinus and defines the lateral limit for removal of the orbital floor. Once the periorbita is fully exposed, multiple full thickness parallel linear incisions are made with a sickle knife in a postero-anterior direction. This is performed at the lateral side of periorbita initially so that prolapse of orbital fat does not obscure the surgeon’s subsequent view. Care must be taken to keep the tip of the blade superficial so as not to injure the underlying orbital contents.

RESULTS

After the operation, 15 eyes measured with an exophthalmometer produced readings ranging from 9 mm to 19 mm and averaging 16.5 mm. The degree of exophthalmos improved in 13 eyes, but two eyes showed no improvement. In the 15 eyes that could be measured post-operatively, the mean of proptosis checked before the operation was 19.3 mm. The reduction of proptosis was statistically significant (p<0.05) according to the paired t test of 15 eyes.

All six eyes with abnormal color vision showed improvement after surgery. The four eyes treated for decreased vision also showed significant improvement, from an average of 0.15 before surgery to an average of 0.78 after surgery.

Acute sinusitis occurred in two patients after surgery. In patient 3, acute maxillary sinusitis occurred on the left side two months after surgery. With two days of intravenous antibiotics producing no signs of improvement, an inferior meatal antrostomy was conducted. This procedure also was unsuccessful in eliminating the condition, so a Caldwell-Luc operation was performed after seven days. In patient 10, sinusitis occurred in the frontal sinus four months after surgery and was successfully treated with antibiotic under hospitalization.

In Patient 6, who underwent a septoplasty at the same time as the orbital decompression, a nasal septal abscess occurred 40 days after surgery. The abscess was treated with incision and drainage.

Six patients complained diplopia before surgery. After surgery, the condition disappeared in two cases but remained in four. Among them, one patient indicated that the condition had actually become more intense after surgery. To treat the diplopia, the ophthalmology department prescribed prism glasses or Min’s glasses, or performed a medial rectus recession on both eyes.

Patient 1 suffered from progressively declining visual acuity in the right eye after surgery, so irradiation was applied from December 1995 to January 1996. Visual acuity conducted on August 1996 improved to 1.0 in
both eyes.
In four cases, including three cases that showed decreased vision, steroid had been used before or after surgery (Table 1).

**DISCUSSION**

Dysthyroid orbitopathy is an autoimmune disease characterized by inflammation, edema and secondary fibrosis.\textsuperscript{7)} The orbitopathy is caused by hypertrophy of the extraocular muscles resulting from hydrophilic mucopolysaccharides and immune complexes deposition in the extraocular muscles and retrobulbar fat. The expansion occurring inside the orbit increases intraocular pressure, causing compressive optic neuropathy. If the expansion continues, blindness may result. The increased intraocular pressure can also result in impaired extraocular muscles function, which may lead to diplopia or strabismus.

Dysthyroid orbitopathy is most commonly associated with Graves’ disease, although reports also link the condition with Hashimoto’s thyroiditis, thyroid cancer and primary hyperthyroidism.\textsuperscript{8)} The clinical symptoms of Graves’ disease include exophthalmos, eyelid edema, lid retraction, conjunctival injection, chemosis, exposure keratitis, corneal ulceration, extraocular motility abnormalities, optic neuropathy and blindness. In most cases, the symptoms progress very gradually and then disappear, but in 2–7% of cases, the condition develops into serious ophthalmopathy, which requires medical treatment.\textsuperscript{9)}

Most patients show improvement after medical treatments such as systemic steroid, local eye care and antithyroid drugs. A high dose steroid can be administered in cases of acute congestive orbitopathy but is difficult to use independently. Steroid treatment also requires long-term period and when the dosage is stopped, the symptoms reappear. Therefore, the administration of steroid is used only as a temporary treatment of optic neuropathy.

External beam radiation is applied as a dose of 20 Gy (2000 rad) divided into ten sessions. This method is effective in the initial, acute stages, demonstrating excellent performance in the treatment of inflammation in soft tissues, but once the tissue has developed into fibrosis, the method is no longer productive.\textsuperscript{10)}

The orbital decompression can be performed to prevent blindness in cases where the treatment of compressive optic neuropathy with a steroid or external beam radiation has been unsuccessful or contra-indicated.\textsuperscript{11)} Other indications include exposure keratitis or corneal ulceration due to severe exophthalmos, extraocular muscles dysfunction or when the exophthalmos hurts one’s outlook. For these cases, the orbital decompression is indicated to enable blinking of eyelids and improve ocular movements.

In the early 20th century, Dollinger attempted an orbital decompression by decompressing orbital contents into the infratemporal fossa through the lateral orbitotomy.\textsuperscript{12)} Since then, several approaches, including the anterior cranial fossa approach\textsuperscript{13)} and the external ethmoidectomy approach,\textsuperscript{14)} have been attempted but the method introduced by Walsh and Ogura in 1957, which is through the maxillary sinus and the nasal cavity, is now most widely used.

In 1990, Kennedy et al., conducted the first orbital decompression incorporating the use of an endoscope,

### Table 1. Summary of endoscopic orbital decompression

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Indication</th>
<th>Op* Site</th>
<th>Preop Vision</th>
<th>Postop Vision</th>
<th>Preop Exophthalmos (mm)</th>
<th>Postop Exophthalmos (mm)</th>
<th>Complications</th>
<th>Other management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46</td>
<td>M</td>
<td>Visual loss</td>
<td>Both</td>
<td>0.2 /0.3</td>
<td>1.0/1.0</td>
<td>108 (21/19)</td>
<td>108 (19/18)</td>
<td></td>
<td>Radiotherapy, steroid</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>0.7 /0.6</td>
<td>1.0/0.9</td>
<td>107 (23/22)</td>
<td>108 (18/19)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>1.5 /1.2</td>
<td>1.5/1.5</td>
<td>102 (19/18)</td>
<td>102 (19/17)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>M</td>
<td>Visual loss</td>
<td>Right</td>
<td>0.03/0.8</td>
<td>0.9/1.0</td>
<td>107 (15/15)</td>
<td>107 (15/15)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>5</td>
<td>41</td>
<td>M</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>1.0 /1.0</td>
<td>0.9/0.9</td>
<td>102 (17/18)</td>
<td>102 (16/15)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>6</td>
<td>43</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>0.5 /0.6</td>
<td>0.4/0.5</td>
<td>103 (17.5/18)</td>
<td>not done</td>
<td></td>
<td>Steroid, Septal abscess</td>
</tr>
<tr>
<td>7</td>
<td>27</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>1.0 /1.0</td>
<td>0.7/0.8</td>
<td>105 (20/19)</td>
<td>105 (16/16)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>8</td>
<td>36</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Left</td>
<td>1.0 /0.9</td>
<td>1.0/1.0</td>
<td>103 (14/17)</td>
<td>104 (14/15)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>9</td>
<td>74</td>
<td>F</td>
<td>Visual loss</td>
<td>Right</td>
<td>0.06/0.2</td>
<td>0.2/0.2</td>
<td>104 (13/11)</td>
<td>104 ( 9/11)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>F</td>
<td>Exophthalmos</td>
<td>Both</td>
<td>0.5 /0.6</td>
<td>0.9/0.9</td>
<td>104 (24/23)</td>
<td>104 (18/18)</td>
<td></td>
<td>Steroid, Acute maxillary sinusitis</td>
</tr>
</tbody>
</table>

*Operation
which allowed access to the nasal cavity and removal of some parts of the medial and inferior walls of the orbit. They reported that in five orbits, the exophthalmos decreased by 4.7 mm. Unlike other transantral or external approaches, endoscopic orbital decompression makes sublabial and skin incisions unnecessary, thus eliminating the possibility of such complications as facial edema, scarring, infraorbital nerve injury or tooth injury. The merits of this method also include a bright and wide view to the posterior orbit, which allows sufficient decompression in the medial orbital wall up to the orbital apex. However, the technique does not yield sufficient exposure of the orbit’s anterior and lateral wall so a lateral orbitotomy may be required.

Despite the fact that decompression of the orbital floor by the endoscopic route compared to the transantral route is limited, the reduction of proptosis by the endoscopic approach is comparable to the transantral route. This is probably because the limited orbital floor decompression is offset by a good decompression of the medial wall.15)

Neugebauer et al., reported that the degree of exophthalmos reduced by an average of 3 mm after endoscopic orbital decompression on 21 patients.16) In a report by Metson et al., 22 orbits that underwent endoscopic orbital decompression showed an average 3.2 mm decrease in exophthalmos and an average 5.6 mm decrease when the treatment was accompanied by lateral decompression conducted through the external approach.15) Koay et al., reported an average 3.9 mm decrease in exophthalmos in 30 orbits that underwent endoscopic orbital decompression.17) In Korea, Cho et al., reported an average 3.5 mm decrease in exophthalmos after conducting both the transantral and endoscopic approaches in ten orbits. Lee et al., reported an average 2.8 mm decrease in 14 orbits after orbit decompression using endoscope only. The results of our study are similar to these findings as we obtained an average 2.8 mm decrease using endoscope only. Despite sufficient orbital decompression, achieved by removing much of the bony lamina, the decreases in proptosis were different than those reported by the authors from other countries. The discrepancy may be attributable to a difference in the size of the nasal cavity and maxillary sinus through which the orbital contents prolapsed. In cases of decreased vision, another possible reason is the smaller volume of orbital fat due to severe hypertrophy of the extraocular muscles. In the two eyes where the exophthalmos was unsuccessful in this study, one patient underwent surgery due to decreased vision and the other had a very narrow maxillary sinus and nasal cavity.

But it is also true that there are some limitations when decompressing the orbital floor frontal and lateral to the infraorbital nerve with an endoscope only. Accordingly, Graham et al., maintain that sufficient decompression of the medial and inferior walls is possible by combining the endoscopic approach and the subciliary approach. The subciliary approach, however, carries a higher chance of damaging the infraorbital nerve when compared to the endoscopic approach.

Contra-indications of endoscopic decompression are cases involving inflammatory disease in the paranasal sinus, underdevelopment of the ethmoid and maxillary sinuses, bony thickening in the orbital wall and severe nasal septal deviation. When a bony thickening exists in the medial orbital wall, access becomes difficult. In these situations, access via conjunctiva provides a wide view of the inferior orbital wall and is relatively safe, since removal of the orbital wall is in the direction running from the orbit to the nasal cavity.

The complications of endoscopic orbital decompression are similar to those of endoscopic sinus surgery. Of these, sinusitis caused by the prolapsed orbital contents is particularly noteworthy.21) During medial wall decompression, it is important that the bony support of the frontal recess be maintained. Preservation of the bony support prevents postoperative obstruction of the frontal sinus due to the escaped orbital fat. As well, the middle meatal antrostomy should be made as wide as possible.

In our study, two patients demonstrated an occurrence of acute sinusitis after decompression in one in the maxillary sinus and the other in the frontal sinus. The maxillary sinus and ethmoid of the patient with maxillary sinusitis were found to be very small, raising the possibility of obstruction of the sinus. Another patient had undergone a septoplasty at the same time as the orbital decompression due to a nasal septal deviation, and exhibited an occurrence of a nasal septal abscess one month after surgery. The nasal packing after the operation was made loose as it exerted compression to the orbit, and this may have allowed a dead space between the mucoperichondrial flap and the septal cartilage. Accordingly, when a nasal septal deviation is severe, making endoscopic orbital decompression difficult, it is recommended that a septoplasty be conducted first and the endoscopic orbital decompression be performed two or three weeks
CONCLUSION

For operators accustomed to using endoscopes, the endoscopic approach to orbital decompression is considered to be an alternative to the traditional transantral and subciliary approaches employed in ophthalmology.

REFERENCES