Transforniceal Lateral Deep Bone Decompression—A Modified Technique to Prevent Postoperative Diplopia in Patients with Disfiguring Exophthalmos Due to Dysthyroid Orbitopathy

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Background/Purpose: Postoperative diplopia remains a significant complication of orbital decompression in dysthyroid orbitopathy. This study evaluated the results of orbital decompression treatment using a transforniceal approach to sculpt the lateral orbital deep bone area.

Methods: The two areas of bone in the deep lateral orbit (the basin of the inferior orbital fissure and the sphenoid door jamb) were exposed using a transforniceal swinging eyelid approach. An electric drill was used to sculpt these deep bone areas of the lateral orbit, and approximately 1 mL intraconal fat was removed simultaneously. Between October 1999 and March 2003, transforniceal lateral deep bone decompression was performed in 35 consecutive patients (62 orbits) with disfiguring dysthyroid orbitopathy. Data on proptosis reduction effect, new-onset diplopia and other complications of lateral wall decompression were analyzed.

Results: The average preoperative Hertel value was 21.2 ± 1.3 mm (range, 18–23 mm) and decreased to 17.4 ± 1.2 mm (range, 15–19.5 mm) postoperatively. The mean decrease in proptosis 3 months postoperatively was 3.8 ± 0.91 mm (range, 1.5–4.6 mm). New-onset downgaze diplopia occurred in two (5.7%) of the 35 patients. Persistent trigeminal paresthesia was noted in one patient (2.8%). No cerebrospinal fluid leak, globe injury or vision deterioration was noted during 9.5 ± 1.7 months of follow-up. The cosmetic appearance was improved in all patients after surgery.

Conclusion: Transforniceal lateral deep bone decompression produces less new-onset, persistent diplopia than traditional inferomedial wall decompression, and provides good cosmesis by using a hidden small incisional wound. This approach appears to be a safe and effective procedure for patients with disfiguring exophthalmos, especially for Asian patients without crease fold. [J Formos Med Assoc 2006;105(8):611–616]

Key Words: basin, door jamb, dysthyroid orbitopathy, lateral wall decompression

The indications for orbital decompression in dysthyroid orbitopathy have evolved over the past 20 years. Optic nerve compression and corneal exposure remain indications for urgent surgical decompression, especially when treatment with steroids or irradiation has proven ineffective.1,2 Improvement in surgical techniques with fewer side effects, and an increasing demand from...
patients for cosmetic rehabilitation, have led to the use of orbital decompression for disfiguring exophthalmos.\textsuperscript{3}

Although the technique of orbital decompression surgery continues to evolve, postoperative diplopia remains a significant complication of all bony orbital expansion procedures. Inferomedial wall decompression, even with creation of a strut at the maxillary–ethmoidal junction, still carries a significant risk of consecutive diplopia and globe displacement.\textsuperscript{4–6} For patients with disfiguring dysthyroid orbitopathy seeking cosmetic rehabilitation, new-onset persistent diplopia would be a significant complication that can affect their ordinary activity. Modification or development of a new surgical technique to prevent new-onset diplopia has thus become a topic of interest in the management of dysthyroid orbitopathy.

Traditional lateral wall decompression involves removal of the anterior portion of the lateral orbital wall and is limited in the degree of orbital expansion that can be achieved.\textsuperscript{7,8} Goldberg et al proposed a surgical treatment for extended lateral wall decompression involving the following three areas of bone in the deep lateral orbit: the lacrimal keyhole, the sphenoid door jamb and the basin of the inferior orbital fissure.\textsuperscript{9} Their technique uses an extended upper eyelid crease incision approach, sculpting three deep lateral bone areas with the removal of intracanal fat. They concluded that orbital decompression surgery of the deep lateral wall can provide adequate volume expansion because of the amount and location of potential space that exists in these three areas of deep bone.\textsuperscript{9} In a subsequent study, Goldberg et al found that lateral wall decompression produced less new-onset persistent postoperative strabismus than balanced medial plus lateral wall decompression for dysthyroid orbitopathy.\textsuperscript{10}

In Asian patients without crease fold, upper lid crease incision for lateral wall decompression as described by Goldberg et al would result in a high deep upper lid crease fold with a cosmetically unacceptable appearance. This study evaluated the results of orbital decompression treatment using a trans forniceal approach to sculpt the lateral orbital deep bone area.

Patients and Methods

Between October 1999 and March 2003, transfor- nicial lateral deep bone decompression was performed in 35 consecutive patients (62 orbits) with disfiguring dysthyroid orbitopathy. All 35 patients gave written consent for participation and the Ethics Committee of National Taiwan University Hospital approved this study. There were 10 males and 25 females with a mean age of 37.3 ± 10.9 years. The average follow-up period was 9.5 ± 1.7 months. All operations were done by the same surgeon. The criteria for lateral wall decompression included: (1) euthyroid state; (2) ophthalmic signs stable with regular follow-up for more than 6 months; (3) disfiguring exophthalmos but without preexisting diplopia in a patient eager to undergo operation for cosmetic rehabilitation. Patients with preexisting diplopia received transfor-nicial inferomedial wall decompressions and were excluded from this study. For patients with acute vision deterioration due to optic nerve compression, transcaruncular medial wall or inferomedial wall decompression was performed and these patients were also excluded from this study.

During the follow-up period, the proptosis reduction effect, new-onset diplopia and other complications associated with lateral wall decompression were documented for each patient.

Surgical technique

Under general anesthesia, the lateral canthus and lower fornix were infiltrated with lidocaine 2% with 1:100,000 adrenaline. A lateral canthotomy of about 10 mm was made, followed by disinsertion of the inferior crus of the lateral canthal ligament. The surgical plane was found between the orbicularis muscles and conjunctiva and retractors, and the arcus marginalis was exposed by cutting through the conjunctiva and retractors. The periosteum was incised just anterior to the orbital
margin from the level of the caruncle to the lateral canthus and up to the orbital roof. Periosteum elevators and curved retractors were used to dissect the periosteum/periorbita from the orbital margin, inferior and lateral walls. The lateral wall was visualized after cauterization and cutting of the zygomaticofacial and zygomaticotemporal arteries and nerves. An electric drill was used to sculpt two areas of deep bone in the lateral orbit (the basin of the inferior orbital fissure and the sphenoid door jamb described by Goldberg et al6), as shown in Figure 1. We could not drill into the lacrimal keyhole area because of inadequate exposure of the lacrimal fossa area via the transscleral approach. After complete sculpting of the lateral deep bone orbit, a crescent knife was used to open the lateral and inferior periorbita, and approximately 1 mL intraconal fat was removed to augment the effect of proptosis reduction. The conjunctiva was closed with interrupted 6-0 vicryl sutures. The lateral canthus was approximated with 5-0 polyester sutures, and the skin was closed with interrupted 6-0 nylon sutures.

**Results**

The average preoperative Hertel value was $21.2 \pm 1.3$ mm (range, 18–23 mm) and decreased to $17.4 \pm 1.2$ mm (range, 15–19.5 mm) postoperatively. The mean decrease in proptosis 3 months postoperatively was $3.8 \pm 0.91$ mm (range, 1.5–4.6 mm). Figure 2 shows a patient with dysthyroid orbitopathy before and 6 months after operation, and Figure 3 shows preoperative and postoperative computed tomography (CT) scans of another patient who received left lateral deep bone decompression.

Among 35 patients, 33 had no diplopia on all gazes after operation. Only two patients (5.7%) suffered from persistent downgaze diplopia (no diplopia at primary position) postoperatively.

Numbness in the distribution of the zygomaticotemporal and zygomaticofacial nerves was noted after operation in all patients. However, all of them recovered within 3 months after operation. Three patients developed trigeminal paresthesia after the operation, which may have been due to accidental damage to the inferior orbital fissure area when sculpting the basin area. These symptoms improved and gradually subsided in two patients during 6 months’ follow-up, but remained persistent in the other patient (2.8%).

![Figure 1](image1.png)

**Figure 1.** “L” represents the area of deep bone in the lateral orbit used for lateral wall decompression. “M” and “I” are the areas for traditional inferomedial orbital decompression.

![Figure 2](image2.png)

**Figure 2.** (A) A 27-year-old woman with disfiguring exophthalmos. (B) Six months after transscleral lateral wall decompression.
No hypoglossus, cerebrospinal fluid leak or globe injury was noted in this study. The cosmetic appearance was improved in all patients after surgery.

Discussion

Postoperative strabismus remains a significant complication of all bony orbital expansion techniques, especially in Graves’ patients with disfiguring exophthalmos. Shorr et al found a 34% incidence of worsened muscle imbalance after orbital decompression for dysthyroid orbitopathy. De Santo reported that the rate of diplopia was 53% preoperatively and rose to 80% after orbital decompression. Garrity et al also reported similar incidences of consecutive strabismus.

Several techniques for lateral orbital decompression have been described. Traditional ophthalmic techniques primarily involved removal of anterior portions of the lateral orbital wall. However, many studies showed that these techniques could not achieve adequate volume expansion and proptosis reduction. Goldberg et al proposed that these techniques should involve three areas of deep bone in the lateral orbit: the lacrimal keyhole, the sphenoid door jamb and the basin of the inferior orbital fissure. They used upper lid crease incision to access lateral deep bone areas, and an electric drill was used to perform lateral wall decompression. They demonstrated that this procedure could effectively remove a sufficient amount of bone from the deep lateral wall for adequate volume expansion, resulting in desirable proptosis reduction. A subsequent study by Goldberg et al reported a mean decrease in proptosis of 4.5 mm for patients receiving the lateral wall orbital decompression procedure only. New-onset postoperative strabismus occurred in 33% of the balanced decompression group and 7% of the lateral wall decompression group. They concluded that lateral wall orbital decompression might produce less new-onset persistent postoperative strabismus than balanced medial plus lateral wall orbital decompression for dysthyroid orbitopathy.

In Asian patients without crease fold, an upper lid crease approach to the lateral deep orbit would, in our experience, result in a deep and highly unacceptable crease fold. We therefore tried to modify the technique of lateral wall decompression described by Goldberg et al by using a trans fornical swinging lid approach to the deep lateral orbit. This approach can provide good exposure to the basin of the inferior orbital fissure and the sphenoid of the door jamb. An electric drill was used instead of a hammer and chisel for sculpting the lateral deep bone in this study. Orbital intraconal fat (approximately 1 mL) was also removed. The average preoperative Hertel value was 21.2 ± 1.3 mm in our study, which seems...
lower than that reported in most previous Western series, 1–3,8–10 which may be due to racial differences. The average postoperative Hertel value was 17.4 ± 1.2 mm. The proptosis reduction effect of lateral wall decompression of 3.8 ± 0.91 mm in this study was less than that reported by Goldberg et al. 10 The reasons for the lower proptosis reduction effect in this study may be due to inability to expose and manipulate the lacrimal keyhole area using the transorniceal approach and the relatively narrow and comparatively tight orbit in Asian patients, which makes more aggressive sculpting difficult. In our previous study of inferomedial wall decompression, 18 a greater proptosis reduction effect of 4.4 ± 2.1 mm for inferomedial wall decompression was found, compared to 3.8 ± 0.91 mm for lateral wall decompression in this study. This finding suggests that lateral wall decompression results in less proptosis reduction effect.

New-onset persistent diplopia developed in only 7% of patients with lateral wall decompression, a frequency that is much lower than the 33% of patients with balanced decompression in Goldberg et al’s study. 10 In addition, only 5.7% of patients with lateral wall decompression developed new-onset diplopia as compared to 21% of patients with inferomedial wall decompression in our previous study. 18 This finding suggests that lateral wall decompression via either a translid or a transorniceal approach may produce less new-onset diplopia than other decompression techniques.

Other complications after lateral wall decompression described by Goldberg et al included cerebrospinal fluid leak, vision deterioration and persistent trigeminal hyperesthesia. 10 In this study, we did not encounter intraoperative cerebrospinal fluid leak, hypoglobus, vision deterioration or globe injury. Three patients developed trigeminal paresthesia after transorniceal lateral wall decompression. The symptoms subsided in two of these patients 3 months after operation, while the third patient (2.8%) complained of persistent symptoms. Transient or permanent trigeminal nerve damage may have accidentally occurred during lateral wall sculpting in these patients. Thus, great care must be taken when dealing with the area around the inferior orbital fissure.

Transorniceal deep lateral wall decompression has several advantages. Firstly, the lateral orbital rim is left intact, which reduces postoperative morbidity. Secondly, the temporalis muscle is exposed only minimally in order to avoid cosmetically disfiguring atrophy and chewing difficulty, which are frequent sequela of coronal orbital decompression. Thirdly, this procedure is faster than temporary removal of the lateral orbital rim. The transorniceal approach also allows easy extension of the surgical field to perform inferior and medial wall decompression if lateral wall decompression itself does not achieve an adequate retroplacement effect. Finally, for Asian patients, transorniceal lateral deep bone decompression can achieve reasonable cosmetic rehabilitation for dysthyroid exophthalmos without inducing an unacceptable crease fold (if the upper lid crease approach is used).

In conclusion, the results of this study suggest that transorniceal lateral deep bone decompression is a safe and effective procedure, with a low frequency of new-onset persistent diplopia and the cosmetic advantage of a hidden small incisional wound. It is a suitable alternative for orbital decompression, especially for Asian patients with dysthyroid exophthalmos.

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References


