Intraoperative visible iris sign detected during ptosis surgery in seven Korean patients who wore eye masks when sleep

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Background: A visible iris sign (VIS) is the apparent visibility of iris color or contour through a closed upper eyelid in patients with aponeurotic ptosis from Western countries. This has been popularly reported in individuals from Western countries because the soft tissue of their lids is much thinner than that in individuals of Oriental descent. There is no report on VIS in individuals of Oriental descent pre- and intraoperatively.

Objective: This study aimed to evaluate patients who wore eye masks when sleeping at night and assess the association between VIS and habitual wearing of sleeping mask while dissecting the eye lids to correct ptosis.

Methods: Among the patients who visited the clinic for cosmetic blepharoplasty from 2018 to 2019, seven patients complained about the inconvenience of wearing eye masks for sleeping at night. Of these, two patients were diagnosed with pseudoptosis, and the others were diagnosed with aponeurotic ptosis preoperatively. Moreover, they presented with allergy, contact lens use, habitual eye rubbing, and dry eye syndrome. VIS was assessed pre- and intraoperatively, and pre- and intraoperative images were obtained. VIS was analyzed intraoperatively. Conventional blepharoplasty with ptosis correction was performed, and morphological characteristics of the lid layers were observed.

Results: Preoperative VIS was not observed in all patients. However, positive intraoperative VIS was detected in six patients, which appeared as a black-colored region due to the defect from the orbital septum, aponeurosis, and Müller muscle. Five patients were diagnosed with aponeurotic ptosis. Moreover, two patients were finally diagnosed with subclinical aponeurotic ptosis because the anatomical defects were observed in these two patients who were preoperatively diagnosed with pseudoptosis.

Conclusion: A sleeping eye mask was most likely used to decrease light transmission through the anatomical defects in patients with positive intraoperative VIS.

Keywords: aponeurosis damage; aponeurotic ptosis; sleeping eye masks; upper blepharoplasty; visible iris sign

Introduction

Patients rarely complain about the inconvenience of wearing eye masks for sleeping at night during cosmetic blepharoplasty consultations because most cosmetic complaints and requirements from patients are focused on morphological improve-

ment. A sleeping eye mask has been widely used to block light during the sleeping period [1]. It allows the users to achieve a deeper level of sleep through the production of melatonin, which promotes rapid eye movement sleep. Moreover, the transmitted light through the eyelids can suppress the secretion of melatonin and phase shift dim light melatonin onset [2].

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Visible iris sign (VIS) is usually found in individuals from Western countries who have severe involutional aponeurotic ptosis [3] with extremely thin upper lid, and eventually, the iris contour and color can be seen through the eyelid skin [4]. However, until now, preoperative VIS is still not reported in Korean patients who have aponeurotic ptosis. Interestingly, the author evaluated 7 blepharoplasty patients who had been wearing sleeping eye masks at night and attempted to determine the relationship between VIS and habitual wearing of sleeping masks while dissecting lids to correct ptosis.

Documented medical histories and images of pre- and intraoperative VIS were analyzed in this study.

Materials and methods

Medical history and chief complaints

Data on history of previous eyelid surgery, allergy/atopy, use of contact lenses, habitual eye rubbing, and preoperative or postoperative wearing of sleeping eye masks were investigated.

Physical examination

Pre- and intraoperative VIS

When the physician gently stretched the upper lid both above and below, the color or outline of the iris is visible through the closed upper eyelid. It indicated positive preoperative VIS [4]. Approaching the aponeurosis with careful dissection during blepharoplasty, the color of the iris is reflected through the lid layers, it is defined as positive intraoperative VIS.

Dissection for transcutaneous blepharoplasty and intraoperative photography

After preoperative marking, a local anesthetic solution (2 ml

of 1% lidocaine with 1/100,000 epinephrine) was administered. The skin and orbicularis oculi were incised; then, the retromuscular middle connective tissue layer was dissected with scissors, and the orbital septum and aponeurosis can be visualized [5]. For correction of anatomical defects, the Müller muscle, aponeurosis, and orbital septum were sutured transversely and vertically using 6-0 polydioxanone monofilament. Conventional blepharoptosis surgery was also performed by levator advancement [6].

Pre- and intraoperative images

Images of the open and closed status of the eyes were obtained using the Canon digital camera (EOS 400D, 50-mm standard lens; Canon, Tokyo, Japan) preoperatively. Immediately after surgical dissection, the image of operative field was obtained using iPhone 7 Plus (Apple Inc., Cupertino, CA, USA) and Note 9 Plus (Samsung Ltd., Seoul, Korea).

Results

Historical findings

A total of 7 patients were included in the study. Preoperatively, two patients (cases 1 and 2) were suspected as having pseudoptosis [7], and the others were diagnosed with aponeurotic ptosis [8] separately. One patient had contact lens-induced ptosis with allergy for 3 years. Five patients had habitual eye rubbing. Postoperatively, only one patient continued to use eye mask for sleeping even though all anatomical defects were corrected. The others can sleep well without using eye masks (Table 1).

Pre- and intraoperative findings

Positive preoperative VIS was not observed in all 7 patients because Korean individuals have darker and thicker skin and

Table 1. Summary of the data of patients

No. of patient	Sex/age (yr)	Wearing the eye mask preoperatively	Previous blepharoplasty	Allergy	Contact lens use	LFT (right/left) ^{a)}	MRD ^{b)} (right/left)	Habitual eye rubbing	Wearing the eye mask postoperatively
1	Female/23	+	-	+ ^{c)}	-	10.0/9.0	2.5/3.0	+	+ ^{e)}
2	Female/26	+	-	+ ^{d)}	+	9.0/9.5	3.0/3.0	+	-
3	Female/52	+	-	-	-	12.0/12.0	3.5/3.0	+	-
4	Female/52	+	-	+ ^{d)}	-	15.0/13.5	2.5/2.0	-	-
5	Female/62	+	-	-	-	6.5/6.5	2.0/2.5	-	-
6	Female/62	+	+	-	-	8.0/8.5	2.0/1.5	+	-
7	Female/24	+	-	-	-	13/12	3.0/4.0	+	-

^{a)}Levator function test (LFT) by Berke's method, ^{b)}margin reflex distance, ^{c)}conjunctival allergy, ^{d)}allergic rhinitis, and ^{e)}considered as a psychological condition.

Table 2. Intraoperative findings and final diagnosis

No. of patient	Pre-/intraoperative VIS	Main location of positive intraoperative VIS	Degree of the defect of the lid (mild, moderate, severe) ^{a)}		Postoperative diagnosis
			Right eyelid	Left eyelid	
1	-/-	Centromedial	Moderate	Moderate	SAP
2	-/+	Centromedial	Moderate	Moderate	SAP
3	-/+	Centromedial	Mild	Moderate	AP
4	-/+	Centromedial	Moderate	Severe	AP
5	-/+	Centromedial	Severe	Severe	AP
6	-/+	Centromedial	Moderate	Mild	AP
7	-/+	Centromedial	Mild	Moderate	AP

VIS, visible iris sign; SAP, subclinical aponeurotic ptosis; AP, aponeurotic ptosis.

^{a)}Degree of the defect of the lids are classified as follows: severe (most or entire thickness defect of the aponeurosis and Müller muscle observed in dark black color or defect replaced by fat), moderate (focal defect of the whole aponeurosis or partial thickness defect of the aponeurosis and Müller muscle detected and observed in light black color), and mild (reduced thickness of the aponeurosis observed in whitish black color).

Fig. 1. Intra- and preoperative photos from patient no. 1 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Blue arrows show the area of partial destruction of orbital septum and aponeurosis. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. A black colored asterisks show Whitnall's ligament. a, anterior layer of the levator aponeurosis; N, perfect layered levator aponeurosis.

thicker orbicularis oculi muscle and middle connective tissue layer with more orbital fat than individuals from Western countries (Table 2, Fig. 1-7).

Fig. 2. Intra- and preoperative photos from patient no. 2 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Blue arrows show the area of partial destruction of orbital septum and aponeurosis. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. a, anterior layer of the levator aponeurosis; N, perfect layered levator aponeurosis; V, VIS sign positive area.

In 6 patients, positive intraoperative VIS was noted at the centromedial part of the lid, which was just above the tarsal plate and expanded superiorly (Table 2, Fig. 2A, B to 7A, B). In case

Fig. 3. Intra- and preoperative photos from patient no. 3 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Blue arrows show the area of partial destruction of orbital septum and aponeurosis. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. N, perfect layered levator aponeurosis; V, VIS sign positive area; S, sutures for fixation of damage layer during dissection; O, Orbital septum; MF, medial fat.

5, an extremely distinct positive VIS was observed on the right eyelid, which showed severe droopy lid due to loss of the whole layer (aponeurosis and Müller muscle) (Fig. 5A, B).

Various shapes of other anatomical defects were also observed on the whole aponeurosis near the Whitnall's ligament superiorly, medial canthus, and lateral canthus (Fig. 1-7). Disinsertion between the aponeurosis and Whitnall's ligament was noted with thinning of the anterior and/or posterior layer of the aponeurosis. In some cases, exposure of subaponeurotic fat and arteries was observed (Fig. 1A, 2A, 3B, 5B, 6A, B). In most patients, the medial defect of the aponeurosis was occupied by fat.

The lateral aponeurosis appeared normal in three cases. It was slightly thick due to lateral shifting of the attenuated or detached centromedial aponeurosis (Fig. 1B, 2A, 3A, B, 4A, 5A, B, 6A, B). In cases 1, 2, 6, and 7, some lateral fragments were observed.

In the pretarsal or junctional region between the aponeurosis

Fig. 4. Intra- and preoperative photos from patient no. 4 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Blue arrows show the area of partial destruction of orbital septum and aponeurosis. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrow shows partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. A blue colored asterisk (B) shows lower positioned transverse ligament. N, perfect layered levator aponeurosis; V, VIS sign positive area.

and tarsal plate, partial or total defect of the septum and aponeurosis were also observed (Fig. 3A, 4A, B, 5B, 6B). Negative intraoperative VIS was observed in only one patient (case 1; Fig. 1A, B) because she had mild droopy lid with eyebrow elevation. Any VIS was not noted during the surgery even though aponeurotic defects were observed.

Generally, the severity and location of sunken lid, asymmetrical position of the brow, and different heights of lid creases, which were observed preoperatively, were relatively well correlated with the degree of intraoperative anatomical defects (Fig. 1A, B to 5A, B, 7A, B), except revision case 6 (Fig. 6A, B).

Preoperatively, cases 1 and 2 were diagnosed with pseudoptosis. However, several anatomical defects were observed (Fig. 1A, B, 2A, B).

Fig. 5. Intra- and preoperative photos from patient no. 5 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Blue arrows show the area of partial destruction of orbital septum and aponeurosis. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. N, perfect layered levator aponeurosis; V, VIS sign positive area.

Fig. 6. Intra- and preoperative photos from patient no. 6 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Blue arrows show the area of partial destruction of orbital septum and aponeurosis. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. a, anterior layer of the levator aponeurosis; L, lacrimal gland prolapse; N, perfect layered levator aponeurosis; O, orbital septum; V, VIS sign positive area.

Discussion

Generally, positive preoperative VIS is extremely rare in Asian individuals because of their thick and puffy lids [9]. Additionally, it is unusual to dissect the lid extensively in cosmetic blepharoplasty, and most of the dissection range is also limited to the supratarsal region even during ptosis correction surgery.

However, the author paid attention to the patient's complaints of the inconvenience of wearing eye masks for sleeping at night and attempted to determine the correlation of wearing eye masks and eyelid structure and sleep induction.

During the surgery, the author dissected the lid more extensively from the supratarsal area to the aponeuroticomuscular junction of the levator palpebrae superioris (LPS) to observe the whole surface of aponeurosis.

Therefore, the author found the oval-shaped positive VIS with different colors, which depends on the degree of the defect (Table 2, Fig. 2-7). The positive VIS of the dark black color

related to the defects of the orbital septum, aponeurosis, and Müller muscle is shown in Fig. 5A; that of the light black color with partial thickness defect of the aponeurosis is shown in Fig. 2A, B, 7B; and that of the whitish black color with reduction of thickness of the aponeurosis is shown Fig. 6B, 7A. This reveals the closed correlation of light transmission through the lids between the degree of defect and color of positive VIS.

In all cases, VIS was observed at the centromedial region as the main anatomical defect. Besides VIS, anatomical defects of the aponeurosis were observed in various shapes. It is well known that the medial horn is not directly connected to the medial canthal tendon and that the region of aponeurosis is thinner and weaker than that of the lateral canthal region [10]. It indicates that the medial aponeurosis is much more susceptible to mechanical damage, such as habitual rubbing, than the lateral aponeurosis.

The lateral aponeurosis appears thick and plump by the later-

Fig. 7. Intra- and preoperative photos from patient no. 7 who had upper blepharoplasty (A: right eye, B: left eye, C: lid open [primary position], D: lid closed). Black arrows show intraoperative visible iris sign (VIS) sign positive. Green arrows show partial thinning areas of aponeurosis without damage of orbital septum. White arrows show partial thinning and disinsertion of superior levator aponeurosis to Whitnall's ligament. A black colored asterisk shows Whitnall's ligament. V, VIS sign positive area; S, sutures for fixation of damage layer during dissection; O, orbital septum; a, anterior layer of the levator aponeurosis.

al shift of detached aponeurosis from the medial horn (Fig. 2B, 4A, 5A, 6A, B, 7B). Moreover, the medial empty area was also occupied by fat (Fig. 1A, B, 2A, B, 5A, 6A). In contrast, a thin and fragmented lateral aponeurosis was noted in patients who had habitual rubbing (Fig. 1-3, 6, 7). The thinning of the aponeurosis below Whitnall's ligament is shown in Fig. 3A, 4B. The detachment of the aponeurosis from Whitnall's ligament is shown in Fig. 1, 2, 4. Defects of the whole aponeurosis with exposure of the arteries and sub-LPS fat [11] are also presented in Fig. 1, 2, 3B, and 5-7. Preoperatively, cases 1 and 2 were diagnosed with pseudoptosis; however, several definite aponeurotic defects were also observed, and eventually, they were diagnosed with subclinical ptosis.

The location of positive intraoperative VIS is relatively well correlated with the sunken region of each eyelid.

Negative intraoperative VIS was only detected in case 1. The reason for wearing sleeping eye masks postoperatively may

be caused by a psychological condition or the patient's goal to achieve more darkness.

From the above mentioned result with small number of cases and insufficient academic studies, it is inadequate to determine the cause of anatomical defects mainly observed as positive VIS, whether it happened primarily or secondarily or both, if secondarily, whether the habitual rubbing is the main cause. However, this study is considerably worthy as the first observation of positive intraoperative VIS in Korean patients.

The main anatomical defect was observed in the centromedial region of the lid as positive VIS intraoperatively. When the patients close their eyes during sleep, they might feel insufficient darkness or brightness due to increased light transmission through the positive VIS region, eventually, it was necessary to wear eye masks for sleeping as a method to obtain more darkness.

Conflicts of interest

The author has nothing to disclose.

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