Original Article

Subsequent strabismus surgeries in patients with no prior medical records

Won Jae Kim, Myung Mi Kim

Purpose: To investigate subsequent strabismus surgeries in patients with no prior medical record and to evaluate discrepancies between surgical findings and preoperative presumptions made based on patient self-reporting and clinical findings. **Methods:** The medical records of patients who underwent a subsequent strabismus surgery between January 1992 and October 2017 were retrospectively reviewed. Patients with no available medical records were included in analyses. Discrepancies between preoperative presumptions and surgical findings were investigated. Original ocular alignment and previous surgical details were presumed using alternative methods, including patient self-reporting, review old photographs of patient, and checking conjunctival scarring. **Results:** Eleven consecutive patients (4 females, 7 males) met the inclusion criteria. The mean age at subsequent surgery was 47.7 years (range, 23–69). Seven patients had exotropia and four patients had esotropia before the subsequent surgery. Seven patients reported originally having exotropia and four patients reported originally having esotropia. However, findings from surgical exploration did not agree with preoperative presumptions from patient self-reporting in 7 of 11 patients (7/11, 63.6%). These discrepancies included errors in the original type of strabismus (7/11, 63.6%), which eye was previously operated on (1/11, 9.1%), and number of prior surgeries (1/11, 9.1%). **Conclusion:** When planning a subsequent strabismus surgery in patients with no prior medical record, information obtained from the patient should be used with caution. This includes the original type of strabismus and previous surgical details.

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The subsequent surgery to restore ocular alignment is not uncommon in patients with strabismus.[1-3] When determining a surgical plan for patient with strabismus who have undergone surgery previously, it is important to understand the original ocular alignment and obtain as much information as possible about the prior surgery.[4] This includes which extraocular muscles were operated on and how surgery was performed. This information may be readily attainable from medical record, but in some cases, a patient's medical record is unavailable. In these cases, information about original ocular alignment and the prior surgery can be presumed using alternative methods, including patient self-reporting, review of old photographs, and examination of conjunctival scarring using slit lamp examination. Patient self-reporting is the most commonly used method to make preoperative presumption, but this information can be inaccurate.[5,6] If discrepancies exist between presumptions made from patient self-reporting and findings from surgical exploration, these may lead to changing the procedure or surgical amount for favorable surgical outcome. However, to the best of our knowledge, this is the first report on self-reported information validity in patients with strabismus. The purpose of this study is to investigate subsequent strabismus surgery in patients with no prior medical record and to evaluate discrepancies between surgical findings and preoperative presumptions made based on patient self-reporting.

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Methods

This study was approved by the Institutional Review Board of the Yeungnam University Hospital, Daegu, South Korea. Informed consent was waived by the board. The medical records of patients who underwent subsequent strabismus surgery between January 1992 and October 2017 at Yeungnam University Hospital were reviewed. Patients whose prior surgery records were unavailable for review included in this study. All patients underwent a full ophthalmologic examination before the surgery. The original type of strabismus and prior surgical information were collected using a patients' self-reported medical history. Patients were asked to bring their old photographs when possible. At least, 4 months were given for patient to bring their old photographs. The presence of a conjunctival scar was assessed using slit lamp examination to determine which eye or muscles had been previously operated on. The angle of deviation was measured by an alternative prism cover test with an accommodative target at both distance (6 m) and near (1/3 m). The patients with too poor fixation to perform alternative prism cover test were measured with the modified Krimsky test. Duction limitations were evaluated. Stereoacuity was measured using the Lang I

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test (LANG-STEREOTEST AG, Küsnacht, Switzerland) and Stereo Fly Stereotest (Stereo Optical Co., Chicago, IL, USA) when the patient could complete the test. The surgery was performed by two surgeons (WJK, MMK) under general anesthesia. The forced duction test was performed to determine any restriction under general anesthesia. The surgical exploration was usually conducted on the eye presumed to have a surgical history, especially sensory type of strabismus. Patient date, including gender, information of the first surgery based on patient self-reporting, age at the subsequent surgery, surgical findings, surgical procedure, and surgical outcomes were collected.

Results

During the study period, 11 consecutive patients (4 females, 7 males) were identified. Patient characteristics are summarized in Table 1. The mean age at the subsequent surgery was 47.7 years (range, 23–69). Seven patients (Patients 1, 2, 4, 6, 7, 8, and 10) had exotropia and four patients (Patients 3, 5, 9, and 11) had esotropia before the subsequent surgery. Seven patients (Patients 2, 4, 6, 7, 8, 10, and 11) reported their original ocular alignment as exotropia and four patients (Patients 1, 3, 5, and 9) reported their original ocular alignment as esotropia. However, surgical exploration showed discrepancies between surgical findings and preoperative presumptions made based on patient self-reporting in included patients (Table 2, 7/11, 63.6%).

Three patients are described in detail below to better illustrate discrepancies between surgical findings and preoperative presumptions.

Case 1 (Patient 6)

A 53-year-old female visited our clinic for exotropia. She reported that she had undergone a surgery for exotropia in the right eye when she was in her 20s. The patient reported having good ocular alignment for the next 20 years. The patient's prior medical record and photographs were not available for review. Visual acuity was 20/100 in the right eye and 20/25 in the left eye. She demonstrated 30 prism diopters (PD) right exotropia in the primary position without any limitation of ab or adduction [Fig. 1a]. Slit lamp examination revealed nasal and temporal conjunctival scars in the right eye. The refractive error was +3.50 +1.50 D × 110 in the right eye and + 2.00 + 1.00 D × 70 in the left eye. She showed poor stereoacuity. We suspected that she had previously undergone lateral rectus recession and medial rectus resection (R & R) for exotropia and planned the medial rectus re-resection in the right eye. However, surgical exploration revealed that the medial rectus muscle was attached 8 mm posterior to its original insertion [Fig. 1b]. The advancement of the medial rectus muscle was performed in the right eye.

Table 1: Clinical features of patient who underwent subsequent strabismus surgery with no prior medical record

Patient (Gender/Age)	Patient self-reporting of first surgery			SLE
	Age, years	Original alignment	Eye (BCVA)	Conjunctival scar
1 (M/23)	3	ET	Right (NLP)	Right
2 (F/47)	21	XT	Left (20/400)	Left
3 (M/48)	23	ET	Right (20/800)	Right
4 (M/34)	9	XT	Left (20/400)	Left
5 (M/44)	20s	ET	Right (20/400)	Right
6 (F/56)	20s	XT	Right (20/100)	Right
7 (M/41)	10	XT	Left (20/20)	Not detected
8 (M/44)	7	XT	Both (20/20)	Both
9 (M/52)	45	ET	Left (20/800)	Left
10 (F/69)	10s	XT	Left (NLP)	Left
11 (F/67)	30s	XT	Right (HM)	Right

SLE: Slit lamp examination, BCVA: Best corrected visual acuity, ET: Esotropia, NLP: No light perception, XT: Exotropia

Case 2 (Patient 7)

A 41-year-old male presented with exotropia. He reported that he had undergone a surgical treatment for exotropia in the left eye when he was 10 years old. He did not have any old photographs. The visual acuity was 20/20 in each eyes. He demonstrated 40 PD exotropia and 6 PD right hypertropia in the primary position with mild adduction limitation in the right eye [Fig. 2a]. The slit lamp examination did not reveal a noticeable conjunctival scar in either eye. Refractive error was −5.75 +1.00 D × 90 in the right eye and −7.00 +1.00 D × 90 in the left eye. He showed poor stereoacuity. Based on patient-reported information, unilateral R & R in the left eye was suspected as the first surgery. The R & R in the right eye was planned as the second surgery. However, surgical exploration of the right eye revealed that the medial rectus muscle was attached 5 mm posterior to its original insertion [Fig. 2b]. We did not find any evidence that the lateral rectus muscle had been previously operated on in the right eye. The recession of lateral rectus muscle and advancement of the medial rectus muscle was performed in the right eye.

Case 3 (Patient 8)

A 44-year-old male with exotropia and right hypertropia was referred to our clinic for surgical treatment. He reported that he had undergone surgical treatment for exotropia in both eyes when he was 7 years old. Prior medical record was unavailable. The patient did not have any old photographs before his first surgery, but photographs when he was 10 years old showed stable ocular alignment with left head tilting. The visual acuity was 20/20 in both eyes. He demonstrated 25 PD exotropia and 16 PD right hypertropia in the primary position, with 3+ overaction of inferior oblique [Fig. 3a]. The Bielschowsky head tilt test revealed 18 PD of right hypertropia on right tilt and 6 PD of right hypertropia on left tilt. Conjunctival scars were present on both the nasal and temporal sides of the right eye and on the temporal side of the left eye. Refractive error was −0.50 +1.50 D × 180 in the right eye and −1.25 +1.50 D × 180 in the left eye. He had poor stereoacuity. The R & R at the right eye and lateral rectus recession at the left eye were suspected as the first surgery. The medial rectus re-resection and inferior oblique myectomy at the right eye were planned for the second surgery. The inferior oblique myectomy was performed through a fornix incision. During this procedure, the lateral rectus was identified with a muscle hook and was found to be attached posterior to its original insertion. However, the medial rectus was attached 5 mm posterior to the original insertion in the right eye [Fig. 3b]. The advancement of medial rectus muscle was performed.

Table 2: Original type of strabismus based on patient self-reporting and surgical finding of subsequent surgery

Patient (patient self-reporting of original alignment)	Subsequent surgery			Deviation at last visit, PD (follow-up)
	Deviation, PD	Surgical findings, millimeters (surgical finding of original alignment)	Surgical procedure, millimeters	
1 (ET)	XT 50	RMR intact, RLR recessed 7 (XT)	RMR resection 10, RLR re-recession 10	Ortho (14 yr)
2 (XT)	XT 35	LMR recessed, LLR resected (ET)	LMR advancement 4	XT 25, LHo 10 (5 yr)
3 (ET)	ET 50	RMR intact, RLR recessed 7 (XT)	RMR recession 5, RLR advancement 7	Ortho (3 mo)
4 (XT)	XT 50, LHo 10	LMR recessed 5, LLR intact (ET)	LMR advancement 5, LLR recession 8	XT 10, LDVD 12 (4 yr)
5 (ET)	ET 50	RMR recessed incompletely (ET)	RMR re-recession 10 (hang-back)	ET 5, Rho 10 (3 mo)
6 (XT)	XT 30	RMR recessed 8 (ET)	RMR advancement 6	Ortho (26 mo)
7 (XT)	XT 40, RHT 6	RMR recessed 5, RLR intact (ET)	RMR advancement 5, RLR recession 5	LDVD 4 (3 mo)
8 (XT)	XT 25, RHT 16	RMR recessed 5, RLR recessed (?) (ET)	RMR advancement 5, RIO myectomy	XT 6, RHT 6 (12 mo)
9 (ET)	ET 35	LMR recessed 7, LLR resected (ET)	LMR re-recession 11 (hang-back), LLR re-resection 5	ET 6 (20 mo)
10 (XT)	XT 65	LMR resected, LLR recessed 6 (XT)	LMR resection 7, LLR re-recession 14 (hang-back)	XT 14 (4 mo)
11 (XT)	ET 35	RLR recessed 10, RMR intact (XT)	RLR advancement 10, RMR recession 6	XT 30 (2 mo)

PD: Prism diopters, ET: Esotropia, XT: Exotropia, R: Right, L: Left, MR: Medial rectus muscle, LR: Lateral rectus muscle, HT: Hypertropia, Ho: Hypotropia, DVD: Dissociated vertical deviation, IO: Inferior oblique muscle

Discussion

The strabismus surgery strengthens or weakens the impact of the extraocular muscle on the globes to restore ocular alignment. Different surgical methods and amounts may be used based on the type of strabismus and surgeon preferences.[7] Therefore, to ensure favorable surgical outcomes following the subsequent surgery in patients with strabismus, it is essential to obtain accurate information about the original type of strabismus and the first surgery that was performed. These information can usually be obtained from prior medical record. However, some patients do not have access to their prior medical records and patient history is presumed based on information gained from alternative methods. The review of old photography is usually not sufficient to presume original ocular alignment because of low-resolution images, especially if the photo examined is a group picture. Examining scarring with slit lamp examination is helpful in presuming which extraocular muscle had been operated on; however, it is limited in evaluating how the muscle had been operated previously. Therefore, information gained directly from the patient is most commonly used and is an easy method of obtaining medical information without the prior medical record. However, caution should be used with this method because of possible inaccuracies.[8] Previous studies have shown that the accuracy of patient-reported ocular history varies with pathology.[9]

Large epidemiologic studies obtained similar results and indicated that patient-reported information is often inaccurate.[10,11] However, most previous studies examined patients with cataract, glaucoma, and retinal diseases and did not include patients with strabismus. The inaccuracy of self-reporting was observed in patients with strabismus in this study. In 7 of 11 patients in this study, findings during surgical exploration did not agree with preoperative presumption made based on patient-provided information. These discrepancies included errors in the original type of strabismus (7/11, 63.6%), which eye was previously operated on (1/11, 9.1%), and the number of prior surgeries (1/11, 9.1%). The discrepancies between what is expected and what is found may make the surgeon change their preoperative surgical plans. Two patients (Patients 1 and 3) reported that they originally had esotropia and underwent surgical treatment for it, but surgical exploration revealed contrary findings. On the contrary, five patients (Patients 2, 4, 6, 7, and 8) reported that they originally had and underwent surgical treatment for exotropia, but surgical exploration revealed discordant findings. Patient 7 reported he had undergone a previous surgery in the left eye, but slit lamp examination did not provide any clues about that surgery. It is reasonable to presume that patients with sensory strabismus underwent surgery previously on the eye with poor vision. However, this patient had equally good vision in both eyes. Surgical exploration in this patient revealed that the medial rectus in the right eye had been previously operated on, suggesting that the original type of strabismus in this patient was not exotropia, but esotropia. Patient 8 remembered that he had undergone one surgical treatment for exotropia. We concluded that the patient had undergone two prior strabismus surgeries based on surgical findings. We considered that he had esotropia originally and had undergone surgery for esotropia, suggesting a previous recession of medial rectus recession in

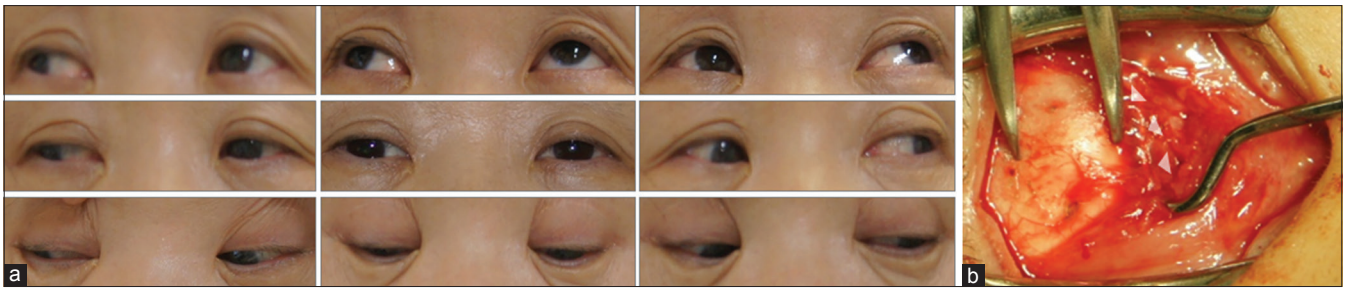

Figure 1: Patient 6 with preoperative nine diagnostic position and surgical finding. (a) Patient demonstrated exotropia in the right eye in the primary position without any limitation. (b) Surgical exploration of the right eye revealed that the medial rectus muscle was attached 8 mm posterior to its original insertion (arrowhead)

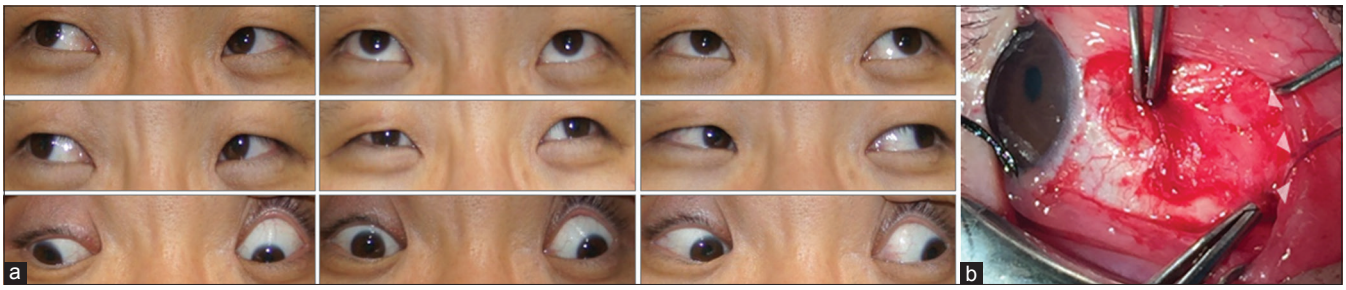

Figure 2: Patient 7 with preoperative nine diagnostic position and surgical finding. (a) Patient demonstrated exotropia and right hypertropia in the primary position with mild adduction limitation in the right eye (right fixation in primary position). (b) Surgical exploration of the right eye revealed that the medial rectus muscle was attached 5 mm posterior to its original insertion (arrowhead)

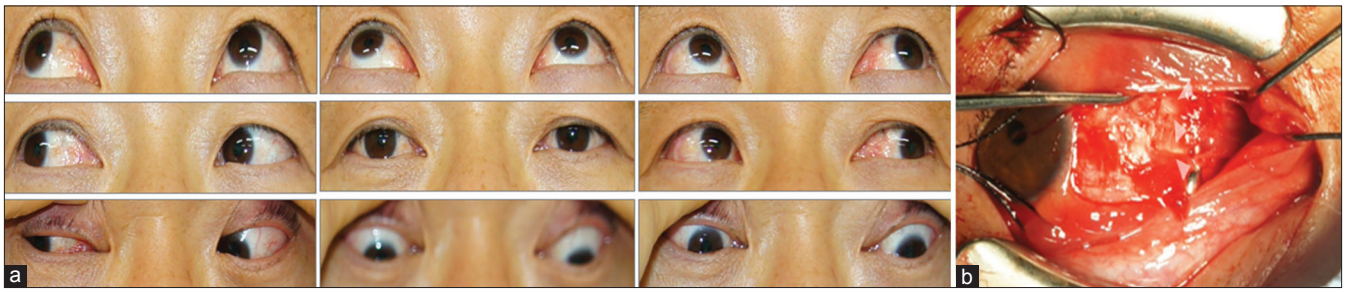

Figure 3: Patient 8 with preoperative nine diagnostic position and surgical finding. (a) Patient demonstrated exotropia and right hypertropia in the primary position, with 3+ overaction of inferior oblique. (b) Surgical exploration of the right eye revealed that the medial rectus muscle was attached 5 mm posterior to its original insertion (arrowhead)

the right eye. Consecutive exotropia developed over time and the patient wrongly remembered his second surgery as his first surgery performed in both eyes. Previous studies have shown that patient-reported information becomes less accurate as the time since last eye examination increases.[11] We postulated that the relatively long time (at least 20 years) between the first and second surgeries in included patients largely contributed to the high error rate in patient reporting.

Based on our experiences, we recommend the followings for surgeon to plan subsequent strabismus surgery in patients with no prior medical record. First, clinicians should always consider the possibility of inaccurate self-reporting when performing preoperative clinical examination. Presumptions of original ocular alignment and first surgery type should not be solely based on self-reported information. Both eyes should be carefully examined for conjunctival scars, even when a patient reports that only one eye was previously operated on. The age of previous surgery can be a good indicator because the exotropia is operated at a later day around 5 years and above, whereas esotropia is operated much earlier.

Second, the measurement of stereoacuity is helpful in patients with good vision. It is known that exotropia is associated with excellent bifoveal fusion and high-grade stereoacuity compared with esotropia because the eyes are well aligned in early infancy when the binocular cortical connections are being established.[12] If patients with exotropia have poor stereoacuity, it is possible that their original alignment was esotropia, suggesting that they currently have consecutive exotropia. Third, surgeons should surgically explore over medial rectus muscle first. If the original ocular alignment was esotropia, the medial rectus muscle will be attached posterior to the original insertion, which suggests that a previous recession had been performed. If the original ocular alignment was exotropia, the medial rectus muscle will be resected or no evidence of a previous surgery will be present. These findings will be helpful in deciding which surgical

procedure to perform. Additionally, ocular imaging devices such as ultrasound biomicroscopy and anterior segment optical coherence tomography may be useful to detect the size and location of extraocular muscles in patients that had previous surgery.[13,14]

This study was limited by its small sample size. Therefore, it was hard to evaluate the effect of age, type of alignment, or time between the first and subsequent surgeries on self-reported information discrepancies. In a large population study, the effect of various patient characteristics on validity of self-reporting can be evaluated in patient with strabismus. This will be a topic for further study.

Conclusion

In conclusion, when preparing for a subsequent strabismus surgery in patients with no prior medical record, patient-reported information should be accepted with caution, particularly for presuming the original type of strabismus and previous surgery characteristics. Surgical exploration can reveal discrepancies between surgical findings and preoperative presumptions based on self-reporting. Surgeons should be aware of this possibility to achieve favorable surgical outcomes in patients with no prior medical record.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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