



# Effect of Trainee Participation on Operative Times in Strabismus Surgery

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J Acad Ophthalmol 2022;14:e74–e77.

## Abstract

**Introduction** This study aimed to describe the difference in operative time during strabismus surgery in the presence and absence of a trainee with the operating physician.

**Methods** This is a retrospective chart review of pediatric patients who underwent strabismus surgery by three surgeons from January 2016 through September 2019. Electronic medical records were reviewed and noted for operative times as well as the presence or absence of a trainee (postgraduate year [PGY]-3 ophthalmology resident, PGY-5 pediatric ophthalmology fellow, or both).

**Results** The average time needed for a two-horizontal muscle recession by all the three surgeons in the absence of a trainee averaged at 35.7 minutes (range: 24–48). This is increased by 34% in the presence of a trainee with an average of 47.88 minutes (range: 20–81) with a *p*-value < 0.001. Similar comparisons were performed for a two-horizontal muscle recession in addition to bilateral inferior oblique weakening procedures for two surgeons. On average, in the absence of a trainee, this required an average of 61.9 minutes for completion with an increase of 31.8% with the participation of a trainee requiring 81.56 minutes.

**Discussion** The presence of trainees, whether residents or fellows, is a crucial component of medical education and training. It is important for their learning and helps develop strong future surgeons. However, this may increase surgical procedure times and affect the efficiency of the primary surgeon. This has important implications for surgical scheduling, surgical time utilization, and surgical productivity of those involved in trainee education.

**Conclusion** The presence of a trainee with a primary surgeon, although crucial to surgical training, may result in significant prolongation of strabismus surgical times.

## Keywords

- ▶ operative times
- ▶ strabismus surgery
- ▶ trainee
- ▶ nonocular surgeries

received  
September 17, 2021  
accepted after revision  
November 10, 2021

DOI <https://doi.org/10.1055/s-0042-1744273>.  
ISSN 2475-4757.

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Resident participation in cataract surgery<sup>1,2</sup> and other non-ocular surgeries<sup>3</sup> has been shown to increase operative times. Competency is thought to be, at least theoretically, increased through the development of standardized surgical curricula and wet laboratories.<sup>4</sup> The relationship between competency and operative time is thought to be inversely proportional.<sup>5</sup> Resident training for strabismus surgery has less defined standards than those for cataract surgery.<sup>5</sup> Tools used to teach and assess resident strabismus surgical skills may include skill-based rubrics or a minimum number of strabismus procedures.<sup>5,6</sup> Some surgical models are present for strabismus surgery but not as sophisticated as those for cataract or vitreoretinal surgery,<sup>7,8</sup> and most training occurs intraoperatively.<sup>5</sup>

The level of experience and training of the assistant has been shown to affect the operative time of strabismus surgery. It was noted to be significantly longer with residents (postgraduate year [PGY]-3) compared with fellows (PGY-5) participating in two-muscle horizontal strabismus procedures.<sup>5</sup>

This study aimed to assess the effect of trainee participation, resident or fellow, on the operative times of strabismus surgical procedures in comparison to those needed by the primary surgeon when operating without a trainee.

## Methods

This was a retrospective chart review study of strabismus procedures performed at the University of Pittsburgh Medical Center Children's Hospital of Pittsburgh. Institutional Review Board approval was obtained prior to conducting the study.

We reviewed the electronic medical records of 174 patients who underwent strabismus surgical by three different surgeons. We looked at successive charts for each surgeon between January 2016 and September 2019. Data collected included: patients' age, sex, age at the time of procedure, procedure performed, primary surgeon, presence or absence of a trainee as an assistant, and operative time. Operative times were calculated from "procedure start" to "procedure stop" times documented in the intraoperative nursing notes.

The charts, included for comparison with and without a trainee, were those who underwent two-horizontal muscle recession procedures or those who underwent two-horizontal muscle weakening with bilateral inferior oblique weakening procedures. Patients who underwent reoperations, horizontal muscle plications, vertical muscle procedures, one-horizontal muscle recession, one inferior oblique weakening procedure, superior oblique procedures, posterior pulley fixation, horizontal muscle resections, or those combined with examination under anesthesia or other nonocular procedures were excluded. Charts ( $N=120$ ) were then reviewed and the presence of a trainee, whether resident or fellow, was noted for each procedure and for each surgeon.

## Results

Of the 174 patients, 120 met inclusion criteria with 65 procedures performed in the presence of a trainee. Forty-

four patients underwent two-horizontal muscle recession with a participating trainee, and 34 patients underwent the same procedure by the attending surgeon alone. For those who had two-horizontal muscle recession with bilateral inferior oblique weakening procedures ( $N=33$ ), five patients performed by one surgeon with a trainee were excluded from the comparison due to lack of patients performed by the same surgeon without a trainee within the study period. Two-horizontal muscle recession with inferior oblique muscle weakening were performed with a trainee in 16 patients and without a trainee in 11 patients.

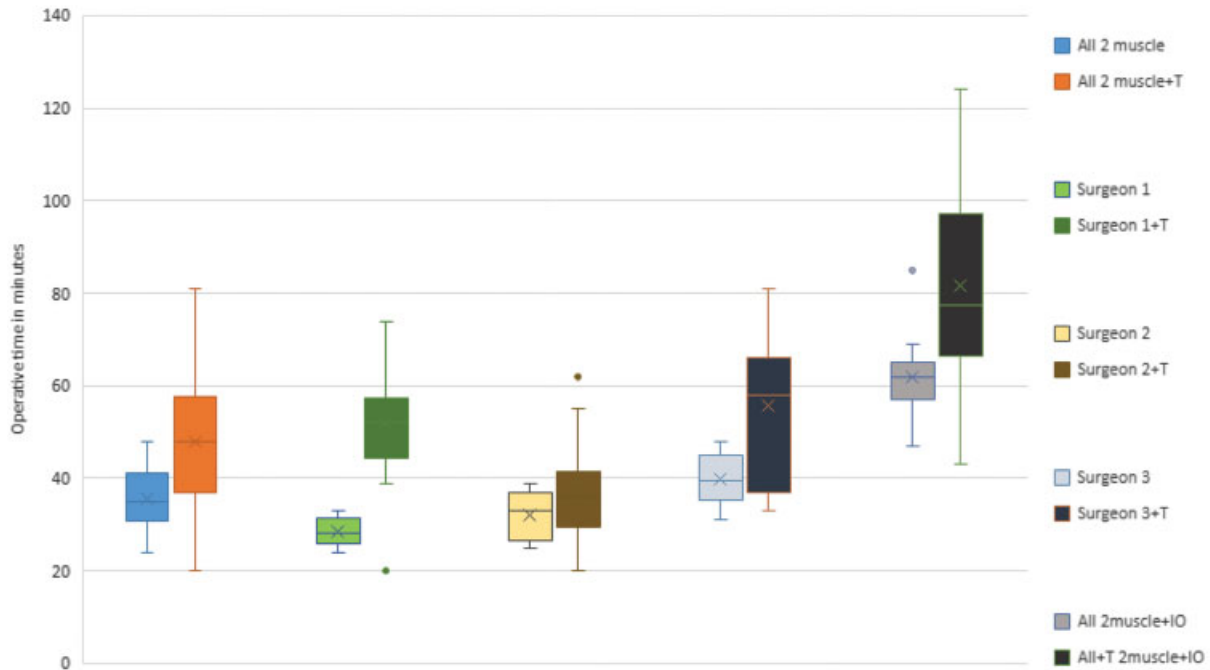
Patients' age ranged from 3 months to 15 years with an average of 4.9 years. Sixty-three were females and 57 were males.

The time needed for a two-horizontal muscle recession by all three surgeons in the absence of a trainee averaged at 35.7 minutes with a range of 24 to 48 minutes (standard deviation [SD]  $\pm 7.04$ ). This duration was increased by 34% in the presence of a trainee with an average of 47.88 minutes and a range of 20 to 81 minutes (SD  $\pm 14.53$ ) with a  $p$ -value  $< 0.001$ . For surgeon 1, this time was 28.53 minutes (SD  $\pm 3.08$ ) when operating alone and an 81.5% increase in the presence of a trainee with an average of 51.77 minutes (SD  $\pm 16.45$ ). As for surgeon 2, this time was 32 minutes (SD  $\pm 5.56$ ) without a trainee and 37.18 minutes (SD  $\pm 9.51$ ) showing an increase of 16.2% in operative time in the presence of a trainee. Surgeon 3 needed 39.85 minutes for this two-horizontal muscle recession procedure (SD  $\pm 5.46$ ) when operating alone and 55.73 minutes (SD  $\pm 16.45$ ) with a 39.9% increase in operating time when operating with a trainee.

Similar comparisons were performed for two-horizontal muscle recession in addition to bilateral inferior oblique weakening procedures for two surgeons, surgeons 1 and 3. Surgeon 2 was excluded from this comparison as there was no procedure performed alone by this surgeon in this group. Eleven patients were performed in the absence of a trainee and required an average of 61.9 minutes for completion (SD  $\pm 9.67$ ). There was an increase of 31.8% on average with a participation of a trainee and required 81.56 minutes on average (SD  $\pm 22.13$ ). Surgeon 1 performed two-horizontal muscle recession with bilateral inferior oblique recession in an average time of 57.5 minutes (SD  $\pm 0.71$ ) when operating alone and 80.8 minutes (SD  $\pm 23.19$ ) with a 40.5% increase in operative time when operating with a trainee. Surgeon 3 performed two-horizontal muscle recession with bilateral inferior oblique myectomy in an average time of 66.43 minutes (SD  $\pm 8.83$ ) when operating alone and 87 minutes (SD  $\pm 16.97$ ) with a 30.1% increase in operative time in the presence of a trainee (**Fig. 1**).

## Discussion

The presence of trainees, whether residents or fellows, is a crucial component of medical education and training. Their participation in surgical cases is important for their learning and helps develop strong future surgeons. However, this may increase surgical procedure times and affect the



**Fig. 1** Illustration of operative times of surgeons in the presence and absence of a trainee. **All two muscles:** Operative time spent by all three surgeons to perform two-horizontal muscle recession without a trainee. **All two muscles + T:** Operative time spent by all three surgeons to perform two-horizontal muscle recession in the presence of a trainee. **Surgeon 1:** Operative time spent by surgeon 1 to perform two-horizontal muscle recession without a trainee. **Surgeon 1 + T:** Operative time spent by surgeon 1 to perform two-horizontal muscle recession in the presence of a trainee. **Surgeon 2:** Operative time spent by surgeon 2 to perform two-horizontal muscle recession without a trainee. **Surgeon 2 + T:** Operative time spent by surgeon 2 to perform two-horizontal muscle recession in the presence of a trainee. **Surgeon 3:** Operative time spent by surgeon 3 to perform two-horizontal muscle recession without a trainee. **Surgeon 3 + T:** Operative time spent by surgeon 3 to perform two-horizontal muscle recession in the presence of a trainee. **All two muscles + IO:** Operative time spent by two surgeons to perform two-horizontal muscle recession in addition to bilateral inferior oblique weakening procedures without a trainee. **All + T 2 muscle + IO:** Operative time spent by two surgeons to perform two-horizontal muscle recession in addition to bilateral inferior oblique weakening procedures in the presence of a trainee.

efficiency of the primary surgeon. This has important implications for surgical scheduling, surgical time utilization, and surgical productivity of those involved in trainee education.

Estimation of anticipated surgical time is crucial to planning operative time blocks and calculating the number of surgeries possible within a time frame. Anesthesia and nursing staff require an accurate estimation to plan schedules and staff requirements.

Our study aimed to compare the operative times of surgeons in the presence and absence of a trainee. Trainees included residents (PGY-3) and fellows (PGY-5). The operative times were calculated by obtaining the difference between operation start and stop times documented in the nursing notes. The presence or absence of a trainee was also obtained from the same notes and verified from the surgical note. Our data showed a significant increase in operative time in the presence of a trainee compared with surgeons operating alone. The time difference varied from one surgeon to the other but was consistently prolonged with a trainee among all three surgeons. The time difference could be due to the level of experience of the trainee as we did not separate those done with a resident from those with a fellow. Another reason may be the extent of involvement of the trainee. The

operative reports did not document the extent that a trainee was involved in the case.

Limitations of the study include relying on accurate nursing documentation, lack of information on extent of surgical trainee involvement in each case and retrospective review. Complex procedures and reoperations were excluded from the comparison, but the exact steps in which a fellow or resident were involved in were unclear. A comparison between fellow and resident participation was not possible as groups were then divided into too small numbers and may not have been accurate. Some cases had more than one trainee involved, a resident and a fellow, and would have been difficult to categorize. The extent of their involvement was left to the discretion of the surgeon where, possibly, those operating faster were given more steps in a single procedure. Additionally, the categories compared did not have an equal number of surgical procedures with and without a trainee.

Nevertheless, operative times were prolonged among all three surgeons regardless of the level of trainee experience, extent of involvement of the trainee, or the actual time needed by the surgeon alone.

This may significantly impact surgical planning and block utilization. Overbooking of patients may lead to prolonged

wait times which add to the stress of the surgery on the child and the family. Another potential risk is rescheduling or postponing the procedures of those not planned adequately. To maintain patient satisfaction without compromising the learning experience of trainees, surgeons must anticipate the potential additional time needed.

Extended anesthesia time in early childhood with developing brains is also another consideration, which could impact language abilities and cognition, as well as brain structure.<sup>9</sup> The added cost to the hospital for additional time in the operating room should also be considered along with the decreased productivity of the primary surgeon.

## Conclusion

The presence of a trainee with the primary surgeon, although crucial to their learning experience, may result in significant prolongation of operative times of strabismus surgical procedures. The additional time should be considered for surgical scheduling and should be a consideration when looking at productivity and, potentially, reimbursement.

### Funding

This work was supported by NIH CORE grant P30 EY08098 to the Department of Ophthalmology, the Eye and Ear Foundation of Pittsburgh, and from an unrestricted grant from Research to Prevent Blindness, New York, NY.

### Conflict of Interest

None declared.

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