Instrument and microscope myopia: What’s all the focus about?

Microscope myopia refers to the tendency of novice and anxious surgeons to accommodate when using the operating microscope. This blurs the image for the assisting and often more senior instructor, who may be limited in his capacity to compensate through adjusting the fine focus at the oculars and by his own presbyopia. Visualization is paramount to safe surgery, and the distraction of constantly refocusing interferes with the attention that should be paid to the surgery at hand. We’ve asked Dre, Yung, Kolin, and Bailey for their advice on addressing this common issue.

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Instrument myopia is the overaccommodation that occurs when looking through an optical instrument such as an operating microscope. Possible causes of instrument myopia include limited field of view, perceived proximity of the target, and improper setup of the microscope. Many factors can affect the magnitude of instrument myopia and thus accommodation. These include pupillary distance (distance between the eyepieces), image magnification, how the microscope is focused (direction of focus), and the user’s microscopy experience. Setting the distance between the two eyepieces based on the surgeon’s distant pupillary distance will minimize convergence since the visual axis of both eyes will be close to parallel. This helps to reduce the accommodation that occurs when looking into the microscope. Higher magnification is believed to induce higher accommodation under the microscope.

Operating microscopes are designed to be parfocal (remain in focus) with change of magnification. However, the microscope must be set up properly before surgery in order for this to occur without inducing excessive accommodation. Parfocal procedure is outlined as below:

1. Set proper eyepiece distance based on distant interpupillary distance.
2. Set both eyepiece diopter settings to “0.”
3. Set the microscope on its highest magnification setting. This will induce the highest accommodation from the user, thus setting the highest accommodation amplitude that is required during surgery. During surgery, lower magnifications will most likely be used and therefore any induced accommodation should be well within the pre-set amplitude.
4. Reset the fine focus control so that it is in neutral position.
5. Bring the microscope down to focus on the object, for example, at the iris plane.
6. Without changing the up and down focus of the microscope, change the magnification to its lowest position. Each eyepiece should be focused in turn by dialing outward to fog and then turning inward until best focus is attained.
7. Make sure the patient’s position is not changed after the microscope is set.

Parfocality is assured by this technique, and microscope myopia (accommodation) during surgery is minimized.

Talia Kolin, M.D., associate clinical professor of ophthalmology, University of Southern California, Los Angeles, and chief of ophthalmology, Veteran’s Administration Los Angeles Outpatient Clinic

Accommodative excess is the exertion of more accommodation than is necessary and is sometimes seen with prolonged near work such as cataract surgery. This is more commonly seen in younger surgeons, especially residents who are anxious or doing a stressful case. When the surgeon overaccommodates, the microscope setting prevents the assistant surgeon from being able to focus. While some residents may complete cases without assistance, it is preferable that the attending monitoring the case be able to see every step. This requires a solution to the excess accommodation.

The first step in ensuring that the microscope setting is suitable for both the young surgeon and older attending is accurate alignment of the operating microscope. Before the surgical procedure begins, the operating microscope must be focused precisely. The surgeon should position him or herself in a comfortable, natural position with a straight back, flat feet, and relaxed shoulders. The oculars should then be zeroed, angled, and positioned for the surgeon’s viewing comfort. High power magnification should be used to adjust the scope manually. Manual adjustment of the microscope at high magnification by the surgeon allows a more accurate focus because of the narrowed depth of field. Once the surgeon has set the microscope, the assistant should adjust the oculars as needed in order to have a clear view of the field. The magnification should then be reduced by the surgeon to a power appropriate to the procedure by using the zoom pedal. This method of microscope adjustment will usually prevent unnecessary accommodation during surgery. In fact once this adjustment is made, fine focusing is rarely needed, and only the zoom pedal should need to be used.

When excess accommodation occurs in spite of proper microscope setup, there are various techniques that can be used to overcome this problem. The attending will quickly realize that he can no longer clearly see the operating field. Sometimes verbal reassurance alone is enough.

EW RESIDENTS

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Cataract tips from the teachers
to halt the surgeon’s overactive accommodation. Most young surgeons have a large range of accommodation and can readjust the microscope so the attending can see, without compromising their view of the operating field.

If verbal reassurance is unsuccessful, the young surgeon can be encouraged to look away from the case when it is safe. This brief glance to a different focal point can relieve the surgeon’s hyperactive accommodation. The surgeon can look away while exchanging instruments, and this will frequently stop the accommodative response.

In rare cases, changing the oculars on the surgeon’s or the attending’s scope to compensate for the excessive accommodation is required. If the accommodation problem persists, the surgeon should have a cycloplegic eye exam to see if a refractive error such as overcorrected myopia, hyperopia, or astigmatism is accounting for the visual difficulties.

In summary, excess accommodation is a common problem but one that can be relieved by straightforward solutions.

Robert S. Bailey Jr., M.D., director, Cataract and Primary Eye Care Service, Wills Eye Institute, and clinical associate professor, Thomas Jefferson University, Philadelphia

When viewing through a microscope, excessive accommodation often occurs even though the instrument is designed to render the magnified object at optical infinity. This overaccommodation is known as instrument myopia. It may be linked to myopia development and progression that is seen in microscopists. The cause of instrument myopia is not certain but is felt by most to be related to what is known as proximal accommodation due to the awareness of the closeness of the viewed object during microscopy.

To the ophthalmology resident learning microsurgery, excessive accommodation may lead to headaches and fatigue, especially in the setting of learning new procedures with longer case times.

Microscope setup is important in avoiding or reducing excessive accommodation. Sitting up with a straight back and neck and having your knees flexed 90 degrees to allow your feet to be directly below your knees on the foot pedals are important ergonomic tips that will allow you to be comfortable during the longer case times. Adjust the eyepiece tilt to make sure your head and neck positions are comfortable. This will also maximize the distance between your eyes and the patient, continued on page 46
This month, I asked the Cornell residents under their program director, Christopher Starr, to review this French study on collagen crosslinking for keratoconus. — David F. Chung, M.D., chief medical editor

In the recently published article “Corneal collagen crosslinking in progressive keratoconus: Multicenter results from the French National Reference Center for Keratoconus,” Asri et al. evaluated the outcomes of corneal collagen crosslinking (CXL) on patients with progressive keratoconus. The authors conducted a large retrospective, uncontrolled, two-center study, which measured corrected distance visual acuity (CDVA), corneal pachymetry, endothelial cell count, Ocular Response Analyzer (ORA, Reichert Inc., Depew, N.Y.) parameters, keratometry values, and surgical complications in progressive keratoconus patients 1, 3, 6, and 12 months after CXL. The CDVA stabilized in 48%, improved in 32.7%, and decreased in 18% of eyes at 6 months. At 12 months, CDVA stabilized in 47.6%, improved in 40%, and decreased in 12% of eyes. Maximum keratometry (K) readings stabilized in 49%, decreased in 35.5%, and increased in 15.3% of eyes at 6 months. At 12 months, maximum K readings stabilized in 68.8% and decreased in 21.3% of patients. Complications resulting in loss of vision occurred in 3.5% of patients. Endothelial cell count and ORA hysteresis were only measured in a small subset of patients, and no significant changes in these parameters were noted.

We applaud Asri et al. for the multiple merits of the study. Although other studies have attempted to investigate the efficacy of CXL in keratoconus, most have been limited by small sample size; Asri et al., however, included a relatively large sample of 142 eyes of 142 patients. Despite the compilation of data from two distinct national centers, the operative CXL protocol and much of the data analysis were performed in a reliable and consistent manner, allowing for reasonable generalization between sites. The evaluation parameters used in this study are consistent with those used in previous studies, allowing for some comparison of the results with those of their predecessors.

This study affirms many of the conclusions of other large clinical trials on the efficacy of CXL in progressive keratoconus, adding to the rapidly growing literature on this novel treatment. In addition, Asri et al. expand upon the current literature by assessing its effect on corneal biomechanics in a limited number of study eyes and by reporting a case of “ocular burn,” a complication not seen in other series. The authors also include a valuable analysis of failure indicators, noting that maximum K value greater than 58.0 D, age older than 35 years, and female gender significantly increase the rate of CXL failure.

Like many non-randomized, non-controlled studies, this one is not without its limitations. As acknowledged by the authors, the study is a retrospective analysis, and unlike some previous studies (Wittig-Silva et al., 2008; Hersh et al., 2009), it does not include a control in the form of untreated fellow eyes. A strong effort was made to standardize the treatment protocol and outcome measurements; however, elevation topography and pachymetry measurements were taken using Orbscan II (Bausch & Lomb, Rochester, N.Y.) at the Bordeaux site and Pentacam (Oculus, Lynnwood, Wash.) at the Toulouse site, potentially confounding the results. The follow-up time of 1 year was significantly shorter than that of many previous studies, which followed keratoconus patients post-CXL for up to 5 years. Another potential confounding factor in the

Corneal collagen crosslinking in progressive keratoconus: Multicenter results from the French National Reference Center for Keratoconus

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Purpose: To report refractive, topographic, and biomechanical outcomes, efficiency, and safety of corneal collagen crosslinking (CXL) 1, 3, 6, and 12 months after treatment.

Setting: National Reference Centre for Keratoconus, Bordeaux and Toulouse, France

Design: Case series

Methods: This retrospective, uncontrolled, double-center study comprised eyes with progressive keratoconus. Uncorrected distance visual acuity, corrected distance visual acuity (CDVA), corneal pachymetry, endothelial cell count, and corneal hysteresis and corneal resistance factor were evaluated at baseline and at 1, 3, 6, and 12 months.

Results: One hundred forty-two eyes were enrolled in the study. At 6 months, the CDVA had stabilized in 53 eyes (48.1%), improved in 36 eyes (32.7%), and decreased in 18 eyes (16.3%). At 12 months, the CDVA had stabilized in 31 eyes (47.6%), improved in 26 eyes (40.0%), and decreased in 8 eyes (12%). At 6 months, keratoconus progression had stopped in 51 eyes (49.03%), and the maximum keratometry (K) value had decreased by more than 1.0 diopter (D) in 37 eyes (35.5%); it continued to progress in 16 eyes (15.3%). At 12 months, keratoconus progression had stopped in 42 eyes (68.8%), and the maximum K value had decreased by more than 2.0 D in 13 eyes (21.3%). The complication rate with loss of vision was 3.5%.

Conclusions: Ultraviolet-A light associated with riboflavin CXL is an efficient procedure to stabilize and improve progressive keratoconus. The results reinforce previous studies highlighting the efficacy and safety of the procedure. A large prospective randomized clinical trial is needed.

Instrument continued from page 45

If all else fails, operate with a presbyopic attending who will let you know he cannot see unless you focus back up with the foot pedal. EW

Editors’ note: Drs. Bailey, Kolim, and Yung have no financial interests related to this article.

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