There are a variety of complications of contact lens wear encountered by the clinician in both asymptomatic (Forister et al 2009) and symptomatic populations (Lee et al 2012). Of these, only direct microbial corneal infection, usually associated with poor care and/or extended wear (Keay & Stapleton 2008), and corneal neovascularization, pose direct threats to vision.

Of this pair of, by definition, more severe contact lens complications, microbial keratitis is usually acute and symptomatic, while corneal neovascularization is usually asymptomatic initially and chronic; slow in progression and hence subject to clinical intervention at many opportunities before vision is affected; provided patients present for contact lens evaluations at reasonable intervals (e.g. 6-12 months). Of interest, reports of contact lens related vascularization of the normally avascular clear cornea have been documented since at least 1929 (Lauber 1929).

Early contact lens wear related corneal neovascularization usually presents as a superficial pannus, commonly at the superior limbus, under the upper lid. As this is likely related to hypoxia (Duffin et al 1982; Chan and Weissman 1996), it is principally associated with extended wear of soft contact lenses, and/or highly minus powered soft lenses and occurs but is not common. The location is likely dictated by the coverage of this area by the upper lid with the additional imposition of a CL edge, particularly if high in minus power (and therefore thick), leading to further decrease in the availability of oxygen at this site.
Physiologically, it is known that hypoxia causes cells to release inflammatory cytokines (e.g. VEGF) which can induce new vascular growth (Shweiki et al 1992). This is as true in the cornea as it is in the retina.

Occasionally toric hydrogel contact lenses can also elicit such a pannus -- but at the lower limbus, where these lenses are thickest by design (Westin et al 1989).

The wear of GP CLs has minimal risk of causing neovascularization but might, if of low oxygen permeability, similarly induce corneal vessels if these lenses chronically ride over the corneal limbus with minimal movement (Duffin et al 1982).

Many other corneal disease conditions, however, can lead to similar appearing pannus, for example phlytenulosis secondary to chronic bacterial blepharitis. More severe disease (e.g. herpetic keratitis, interstitial keratitis due to lues or TB, corneal transplantation, etc) can also lead to corneal neovascularization but these vessels are usually at the depth of the corneal insult (eg often deep in the stroma and not necessarily superficial). Shah et al (1998) found that keratoconic corneas could occasionally also show deep stromal neovascularization, suggesting to these authors that keratoconus might be a disease with low grade inflammation (consistent with other research (e.g. Lema and Duran 2005)).

But even though the “normal” soft lens pannus appears mild and only slowly progressive, do not be complacent in the diagnosis and management of contact lens related corneal neovascularization. Patients can eventually suffer vision loss (Wong et al 2003). Such loss may be due directly to the vessels’ presence if they reach the corneal apex, but even more so indirectly when/if the vessels leak lipids into the normally transparent corneal stromal apex. It is the nature of new blood vessels, whether in the corneal stroma or the retina to be “leaky”; we also know this from our understanding of the pathophysiology of diabetic retinopathy. It is likely that any systemic hyperlipidemia will accentuate this process, as was true in the case reported by Wong et al (2003). These vessels may also break easily leading to intracorneal hemorrhage (Donnenfeld et al 1991); this is quite rare but the author has seen several patients with this condition.

Management of contact lens wear induced corneal neovascularization in the second decade of the 21st century, however, is much improved compared to previous years, with the availability of modern contact lens designs and highly oxygen permeable materials.

Many patients can be helped by just decreasing wear from extended to daily use, and perhaps increasing the oxygen permeability of the lenses they use (e.g. refitting from a hydrogel to a silicone hydrogel). Photo-documentation to monitor vessel length is helpful in these cases as the blood column often continues to be observable in the vessels.

Another usually successful technique is to refit to rigid GP CLs (Chan & Weissman 1996), provided as noted above that such GP lenses do not ride over the limbus. With GP lenses, and strictly daily wear, commonly the vessels become ghosts so that photo-documentation is not as helpful.

Both topical steroid treatment and laser closure of the vessels (and some other surgical procedures as well) have been clinically attempted but without much documented success and with risks of additional problems.
If vision dysfunction is severe, and especially if due to lipid deposition in the corneal apex, unfortunately, it is most likely that the patient will require a corneal transplant, perhaps lamellar or penetrating, to restore vision.

The final clinical maneuver would be to discontinue CL wear, if new corneal vessels continue to grow after the patient is restricting wear to daily use and the lenses are of the best mechanical fit and highest oxygen transmissibility available. This would be very unlikely, in the author's clinical experience, unless the lenses used were sclerals, wherein oxygen availability may be limited not only by the transmissibility of the lens itself but also by the thickness of the tear layer between the lens and the cornea (Jaynes et al 2015).

In conclusion, while corneal neovascularization is one of the common complications of contact lens use, such new corneal vessels can also be observed as signs of other corneal diseases. The clinician must therefore consider other causes and work through an appropriate differential diagnosis process.

If contact lenses are the only likely cause, the clinician should consider treatment options and monitor at reasonable intervals to provide his or her patients with successful outcomes.
References:


The Issue of Contact Lens Related Corneal Neovascularization

By: Barry Weissman, OD, PhD

Answer the following 10 questions to the best of your ability. To receive CE credit, please fax in your answers to 916-448-1423 or mail them to California Optometric Association, Attn: CE, 2415 K Street, Sacramento, CA 95816. Answers are due May 15, 2015. Test submissions are entered every Friday; transcripts are available every Saturday morning.

1. Corneal neovascularization has only been associated with contact lens wear following the introduction of modern gas permeable lenses.
   A. True
   B. False

2. Complications of contact lens wear that can threaten vision include
   a. Microbial keratitis and corneal neovascularization
   b. GPC and sterile corneal infiltrates
   c. Myopic shifts and mucin balls
   d. Poor contact lens adaptation and blinking

3. The most likely cause of contact lens related corneal neovascularization is:
   a. Microbial keratitis
   b. Hypoxia
   c. Poor compliance with contact lens solutions
   d. Poor contact lens handling

4. If vision is severely affected by corneal neovascularization, treatment is primarily:
   a. Surgical
   b. Pharmacological
   c. Refitting
   d. Discontinuing CL wear

5. Contact lens neovascularization is NEVER at the inferior limbus.
   A. True
   B. False

6. Surgery is always indicated for corneal neovascularization.
   a. True
   b. False

7. Corneal neovascularization primarily occurs with
   a. Low DK soft lenses used on extended wear
   b. Rigid GP lenses used for daily wear
   c. Daily wear silicone hydrogel lenses
   d. Contact lenses to correct hypermetropia

8. Corneal neovascularization can cause corneal opacifications by leaking:
   a. Sugars
   b. Salts
   c. Lipids
   d. Polyhema

9. The complication of contact lens wear that causes the most concern, because vision is acutely and directly threatened, is:
   a. Corneal neovascularization
   b. GPC
   c. Microbial keratitis
   d. Lost lenses

10. A contact lens wear complication is
    a. A problem that occurs during contact lens wear
    b. A problem that occurs because of contact lens wear
    c. A problem that causes eye damage
    d. A and b