Optometric management of the pterygium

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Abstract
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Degree Type
Thesis

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OPTOMETRIC MANAGEMENT
OF THE
PTERYGIUM

by
Scott R. Walt
Steven Meyers

February 5, 1982
OPTOMETRIC MANAGEMENT OF THE PTERYGIUM

Researched and reported by
Scott R. Walt and Steven Meyers

Pterygiums have been recognized and described for approximately 3000 years. Although during this time a great deal of information has been acquired concerning the characteristics of pterygiums, there are still many questions about them that remain unanswered. In this paper we will discuss various aspects of pterygiums, the questions that are still unanswered, and the role of the optometrist in caring for them.

Suruta, an Egyptian surgeon in 1000 B.C. described the occurrence of pterygiums as common in his time and he also described one of the oldest surgical procedures of them on record. Suruta believed pterygiums were due to a nutritional deficiency. Aetius, a physician in Constantinople, described a surgical procedure for the removal of a pterygium in the fifth century B.C. Pterygiums were also described by Hippocrates in 460 B.C. and Galen in 131 A.D. As information has been gathered, a consistency in conditions has been noted.

Personal observations of both optometrists and ophthalmologists have shown that pterygiums are very frequently seen in warm, dry, windy and dusty regions but less frequently in still, humid and warm regions of the south. People, such as ranchers and farmers, whose occupation causes them to be exposed repeatedly for long periods of time to these first conditions are seen to have a higher incidence of pterygiums. A study of saw-mill workers, in particular, brought out some interesting information. A
A 25% age-adjusted prevalence rate was found in sawmill workers compared to a 7% rate in the control group and the data indicated that the chance of developing a pterygium increased with the length of employment at the sawmill.\(^3\)

Geographically speaking, pterygiums occur at an incidence of less than 1% in the population of peoples between the poles and 40° latitude. More specifically, the so-called "pterygium belt" has been defined as that area from 37° north latitude to 37° south latitude.\(^4\) This describes a strip of area which encircles the earth and is symmetrical with respect to the equator. This, of course, fits in well with the previously listed warm, dry, windy and dusty conditions.

In order to obtain more information concerning the characteristics of those people with pterygiums, studies have been conducted with specific people populations. For example, the Navajo Indians who live in north-eastern Arizona have been found to have a high incidence of pterygiums. An interesting factor that goes along with this occurrence is that this area has a greater amount of ultraviolet light than in any other location in the United States.\(^5\) Eskimos have been found to have what would appear to be a surprisingly high rate of pterygiums considering that the previously listed condition of a warm climate is for the most part not fulfilled. However, multiple reflections from the snow are thought possibly to play an important part in this. One source states the rate of incidence in this population to be 9%.\(^3\) A study completed in Newfoundland reports that men over the age of forty have a 33% occurrence rate of pterygiums.\(^3\)
The occupations of those with pterygiums were primarily woodsmen and fishermen.

A study was also completed in Israel which presents some statistics that tend to be difficult to explain. The most prominent fact that stands out concerns pterygium incidence in relation to occupation. Being an agricultural country, we would typically expect a significantly higher incidence of pterygiums in those people working outdoors. However, it was found that those people who work indoors had 49% of the pterygiums and outdoor workers had only 51%. This slight difference is in no way significant. Since the factors that apparently correlate with pterygium occurrence are only largely in effect out of doors, there appears to be no obvious explanation for the findings of this study. A possible explanation for this discrepancy is that the work hours are from very early morning until noon, similar to field workers in the United States. This schedule, therefore, allows workers to avoid harsh midday conditions which lead to pterygium development.

The physical location of pterygiums has also been observed in studies. One such study has found that 91% of the people with pterygiums had them on the medial side and that 25% of the cases were bilateral. The study in Israel, previously mentioned, found only four people out of 460 (0.87%) had exclusively temporal pterygiums. In addition, a pterygium was not found which extended beyond the center of the cornea. An interesting and unique sidelight is that a statistically significant number (to the .002 level) had left sided prevalence. Another study, however,
found a higher rate (2.4%) of temporal pterygiums and no difference in occurrence between the right and left eyes. A finding widely agreed upon was that a large percentage of temporal pterygiums seen are found in conjunction with a nasal pterygium.

Another factor widely agreed upon is that there is no significant difference in the rate of pterygium occurrence in males and females. Only one study was specific enough to mention that 52% of the cases were female, which was not significant.

The average age of those studied who had pterygiums was 44. Pterygiums are rarely seen in people under twenty years of age, with an occurrence of only 0.14% in children under sixteen. The highest prevalence rate, on the other hand, occurs at age fifty. A decline can be observed in occurrence from then on, especially after age 70. It appears from longitudinal observations that pterygiums regress with senescence. However, despite the facts which have been collected concerning age, no significant age-incidence relationship can be found. The exceptions to this are the extremes as in the very young or very old person.

Studies which have been conducted within families have found pterygiums to be carried as a dominant trait with variable penetrance. The inherited characteristics have been described as--varying sensitivity to ultraviolet light, prominence of the eye from the orbit causing greater exposure (as seen in Polynesians), variation in the amount of lacrimal secretion and a variation in the blink rate. One study specifically describes 19 year old twins. It was believed that few, if any, environ-
mental factors had a significant role in the development of their pterygiums at this age. It was observed that the formation and development of the pterygiums were similar. Careful scrutinizing of the family tree in this case suggested autosomal dominance with incomplete penetrance.

Another study was done on a specific population of people according to their refractive status. Myopes living at the equator where conditions were sunny, windy and 50% humidity were found to have an incidence of only 6.2%. It is believed that the glasses worn by these people acted as a protective barrier for the eyes, thus shielding them from the harsh environmental factors. This possibility will be discussed to a greater extent later in the paper.

Pingueculas are considered by some authorities to be a precursor to pterygiums, so, for this reason, we will take a brief look at them.

When observed through the slit lamp, pingueculas are seen as avascular elevations of elastic tissue which are surrounded by conjunctival blood vessels of normal size. These normal sized vessels may send extremely fine vessels into the elevation. An inflamed pinguecula will have engorged conjunctival blood vessels at the limbus and surrounding the less vascular pinguecular elevation.

On the other hand, a rapidly growing primary pterygium can be described as a vascular structure of blood vessels and loose fibrous connective tissue which is covered by epithelium. The pterygial conjunctival stroma is formed by the combination of masses of amorphous hyalin and fragmented collagen fibers to form granular basophilic material. Also seen at this
point are new blood vessels and an accumulation of large mononuclear connective tissue cells. Histologically, the structural modification of stromal protein creates pterygium angiogenesis factor (PAF) which is mitogenic to endothelial cells of conjunctival capillaries. In the head of the pterygium, Bowman's membrane is replaced by the active proliferation of endothelial vascular buds. In front of these vascular arcades, a zone of edema can be found which extends into the stroma. This edematous area extends out ahead of the pterygium head. Also, at the head of the pterygium we can see lipoid degeneration of the cornea. This is part of a protective process of the eye which takes place to inhibit growth.

In contrast to the actively growing pterygium, there is no edema preceding the head of a stationary pterygium. Other characteristics of a stationary pterygium are that the vascular channels are closed and there can be seen an increase in fibrous connective tissue.

Ptetygiums which fall between the two previous categories, such as those which are slowly growing or extend laterally into only one third of the cornea, have blood vessels that go only as far down as Bowman's layer. However, the blood vessels of rapidly growing pterygiums extend into the stroma. The base of the pterygium is also broader. If these deep blood vessels are not removed, they will have a high probability of recurrence.

Unfortunately, no one specific grading system is being used universally to describe pterygiums. A typical grading system describes a pterygium with two numbers. The first is a roman numeral which grades the de-
gree of vascularity from I to V, I being minimal and V being maximal.
The second number simply tells the amount of advancement onto the cornea
in millimeters. A basic system like this allows us to form a good mental
picture of what the pterygium being described looks like.

A table has been constructed categorizing pterygiums and describ-
ing those categories.

<table>
<thead>
<tr>
<th>Recurrence Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive</td>
<td>68%</td>
<td>65%</td>
</tr>
<tr>
<td>Mildly prog</td>
<td></td>
<td>4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age of recurrence</th>
<th>Recurrence</th>
<th>Recurrence</th>
<th>Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40-92%</td>
<td>&gt;40-26%</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

| Recurring size    | Larger     | Same       | Smaller    |

A pterygium is rarely seen to cross the limbal area of a patient
with arcus senilis. At this time we believe that the lipoid deposition
of arcus senilis inhibits growth as does corneal lipoid degeneration
previously mentioned. This fact correlates well with the finding that
few pterygiums are seen in the older generation, such as those seventy
and above. We also need to take into account, however, that this age
group usually spends a great deal of time indoors.

Although the pterygium has been identified for thousands of years,
no definitive etiology has yet been established. The great deal of re-
search invested in the study of pterygiums through the years, however,
has produced an enormous variety of etiological theories, as well as methods of treatment.

In 1804, Richter stated that a pterygium is always preceded by a pinguecula. Scarpa maintained in 1916 that the underlying cause is a chronic conjunctivitis. Schreiter, in 1872, postulated that the pterygium is a neoplasm, a polypoid growth of the conjunctiva. In 1887, Theobald suggested that fatigue of the medial and lateral recti were at least part of the etiology. Fuchs wrote a very influential paper in 1891 in which he attempted to divide pterygiums into categories of stationary or progressive, depending on the color and consistancy. He also stated that a temporal pterygium never occurs without a medial one and finally, he agreed with Richter in stating that a pterygium is always preceded by a pinguecula. Hubner, however, documented the fact that a pterygium could occur without originating from a pinguecula. This work was done in 1898. Merigot de Treigny and Coime reported in 1933 that pterygiums were most prevalent in countries with a hot, dry climate and one in which wind and dust are generally present. In 1936, Diponegoro and Mulock Houwer implicated infrared radiation as the causitive factor. Beard and Dimitry suggested in 1945 that a choline deficiency was responsible. In 1954, Kamel made a general statement that the pterygium was caused by chronic irritants which he did not specify. Kerkenezor was the first to suggest that ultraviolet radiation stimulates the development of the pterygium. This was put forth in 1956 and in 1965 Cameron authored an entire book about pterygiums in which he came to the same con-
clusion. However, in 1967, Detels and Dhir did studies on sawmill employees who worked indoors. They concluded that there was more than ultraviolet radiation alone that was responsible for the development of pterygiums.

It can be seen from this brief history that the problem of the etiology of the pterygium is a complex one. In order to simplify the comparison and evaluation of the theories, they will be grouped under five major headings.

A. HEREDITY

To substantiate any claim that heredity is a factor in the etiology of pterygiums would be difficult since members of the same families usually reside in the same environment. Control of the environment as a variable would be essential in any study of heredity factors and this has not yet been done. Studies on identical twins have been few and generally inconclusive as well. It has been reported that a baby born with a pterygium had a paternal grandfather with a pinguecula. The attending physicians ruled out an intrauterine infection as a possible cause, leaving heredity as a possible factor instead. However, ophthalmologists reviewing the case questioned if in fact it was actually a pterygium that was present.

Epidemiological data seems to indicate that heredity has very little, if any, involvement in the etiology of pterygiums since family members who move to an area of high incidence tend to develop them far more frequently than those who remain behind.
B. PINGUECULA THEORY

The theory that a pinguecula always precedes a pterygium has been espoused by many persons through the years. The most current proponents of this theory maintain that an irritant causes damage to the epithelial cells of the cornea and conjunctiva which subsequently die. The bare subepithelial cells then begin to proliferate and form a granulated tissue which grows above the level of the surrounding epithelial cells. This small elevation lies above the normal tear film layer and is thus subject to further drying, which can bring about further destruction and proliferation. The theory thus holds that the pterygium is always preceded by a pinguecula. In the following sections we will discuss the various explanations given as to what causes the pinguecula to form.

Other researchers have demonstrated that a pterygium can occur independently of a pinguecula and they also point out that the vast majority of pingueculas never develop into pterygiums. Few argue, however, that a pinguecula can precede a pterygium.

C. CHRONIC IRRITATION

Chronic irritation, as a cause for pterygiums, may play a large or small part in many etiological theories. Irritants can be any material that can enter the eye in the form of particles. Dust appears to be the primary offender, especially when driven by strong winds. Sawdust has been implicated in a study of pterygiums among sawmill workers.

Although solar radiation is also classified as an irritant, it will be discussed separately.
A hot, dry climate increases the effect of foreign particles in the eye by increasing the evaporation of tears. As the rate of evaporation increases, the mucous membrane becomes directly exposed to the atmosphere for a period of time during which dust gets onto the membrane and adheres. If this takes place over an extended period of time, hyperemia and cell death occur resulting in proliferation of the underlying tissue. This process is thought to lead to the development of a pterygium. This hypothesis has some epidemiological support in that pterygiums are most prevalent in hot, dry, dusty and windy areas. In the United States this would include the farm lands of the Midwest and the ranch areas of the Southwest. Ranchers and farmers who appear to have the greatest exposure to these irritants also are among the population of peoples with the highest incidence of pterygium development.

It is thought by some that the reason temporal pterygiums are extremely rare is because the upper lid and eyelashes offer much greater protection to the temporal conjunctiva than to the nasal conjunctiva. Irritants, then, reach and irritate the temporal conjunctiva much less frequently and therefore cause fewer pterygiums.

D. THE DRY EYE THEORY

The dry eye theory is closely related to the chronic irritation theory in that the dry eye allows irritants to act upon the conjunctiva in a way they normally would not be able to. However, a pterygium-like lesion has been seen in patients with superficial punctate drying alone. This has been demonstrated by fitting a patient with a scleral contact lens in which an air bubble rests in the same position on the conjunctiva.
Over a period of unspecified time the patient will develop a pterygium-like lesion. A similar example is said to be seen in wearers of hard contact lenses who develop 3-9 staining. This staining is said to be the result of poor swiping of the area with tears due to the elevation, or a disrupted blink mechanism. The blink is either incomplete, of lower than normal frequency or a sphincter blink in which the facial muscles are contracted to produce the blink. It is believed that in the case of the sphincter blink, Bell's phenomenon does not occur, leaving the cornea and conjunctiva susceptible to damage through drying. The observation that pterygiums do not occur in animals has been tied to the fact that animals have no voluntary control over their blink rate mechanism as humans do. Therefore, there is never a significant change in their blink rate and thus a lack of development of pterygiums.

In addition to a disrupted blink mechanism, other causes of a dry eye might be due to a deficiency in any of the three tear layers, or an altered corneal surface to which the mucous portion of the tear layer will not adhere. A thorough discussion of the numerous conditions which could cause a tear layer deficiency is beyond the scope of this paper. However, suffice it to say that although two layers may be perfectly normal and one layer is deficient, the entire tear layer is greatly reduced in its function of lubrication of the eye. It is also important to note that an altered corneal surface could be the result of a chronic irritation or trauma. Finally, continual exposure to a hot, dry wind can cause a dry eye syndrome.
Regardless of what may have caused the dry eye condition, most agree that once the eye is in this condition it allows irritants to have direct contact with the conjunctiva which eventually causes epithelial cell death and subepithelial proliferation. Therefore, this theory is equivalent to the chronic irritation theory and a dry eye in itself has not been shown to cause a pterygium. Goldvery, in 1976, claimed that there was no statistically significant correlation between the dry eye and pterygiums. 22

E. RADIATION

In the 1930's, infrared radiation was held by some to be a cause for pterygiums. Subsequently, however, it has been shown that the hottest geographical areas often have a lower incidence of pterygiums than cooler places and that heat alone has never been shown to produce specific biological changes which are evident in pterygiums. 1

Ultraviolet radiation was first suggested to be a cause of pterygiums in 1933 but did not gain much popularity until the 1960's when Cameron wrote his book implicating ultraviolet light as the probable cause. The majority of theories today in some way contain ultraviolet light as a factor. Cameron maintains that ultraviolet light penetrates the conjunctiva and acts directly on the subconjunctival tissues, creating an inflammatory, fibroblastic response. The fibroblasts penetrate the space between Bowman's Membrane and the epithelial basement membrane causing a fibrotic reaction and bringing about an ingrowth of connective tissue from the subconjunctiva. The subconjunctival tissue, which is already thickened because of the ultraviolet radiation, invades the cornea at the level of Bowman's Layer. 1 Elliot, in 1966, implicated a photochemical reaction
which causes epithelial cell death as the initial step. When the epithelial cells die, they leave the subepithelial cells exposed thus initiating proliferation. 9

Cameron bases his conclusion heavily on epidemiological evidence which shows a correlation between pterygiums and areas of high ultraviolet radiation and the fact that a study of spectacle wearers in a high incidence area showed a markedly lower incidence. 1 It should be remembered, however, that the areas of high ultraviolet radiation are often hot, windy and dry. The spectacle wearers, although not totally shielded from wind and dust, would be much more protected from them than the general population to which they were compared. Since the occupations of the spectacle wearers were not mentioned in the study, one may question if they were carefully matched to those of the control group.

A study previously mentioned, by Detel and Dhir, in 1967, reported that indoor sawmill workers were developing pterygiums at a significantly greater rate than those not working at the mill. Data analysis also showed that the possibility of a person developing a pterygium increased according to the number of years they had worked in the mill. 3 This study would seem to nullify the theory that ultraviolet light alone is the cause of pterygiums since the workers had minimal exposure to that light due to working indoors. The possibility of limited exposure from working in a pond outside was not mentioned.

It is apparent that although several of the previously mentioned theories have some involvement in the etiology of pterygiums, no single theory is completely adequate in itself. Therefore, many additional
theories have been proposed which combine different portions of the above mentioned theories in an attempt to create a satisfactory completed theory. This is exactly what the authors have done in developing an etiological theory.

Essential to an etiological theory is the disruption of the subconjunctival tissue producing proliferation. This can be accomplished two ways. The first way is to be exposed to ultraviolet radiation. This passes through the epithelium and acts directly on subepithelial tissue producing disruption and subsequent proliferation. Alternately, chronic irritation that is accompanied by, or causes production of, a dry eye in return causes epithelial cell death allowing irritants to act directly on subepithelial cells. This produces the same result as the ultraviolet radiation. It should also be noted that radiation and irritants can be working simultaneously to produce the changes. Therefore, if the exposure is relatively mild or not continuous over an extended period of time, the final result may simply be a pinguecula. If, however, it is severe or the exposure is extended, a pinguecula may form and then proceed on to a pterygium or the proliferation may progress directly to the form of a pterygium.

As a result of the disruption of the subepithelial tissue, the epithelium becomes proliferative and begins to move towards the limbus. The pterygium will become established at the limbus but will not invade the cornea unless there is damage to the corneal epithelium. The irritant that damages the corneal epithelium may vary. Dust, wind and
a dry eye seem to be the leading causes. As the corneal epithelium is damaged, invasion can occur since the proliferative conjunctival epithelium is reproducing at a faster rate than that of the corneal epithelium. As the pterygium progresses, it begins to lose its nutritional support. At this time the corneal epithelium can reproduce equally as fast, thus slowing and eventually stopping the invasion of the pterygium.

It can be seen then that a possibility of several factors can be at work in the development of the pterygium. Ultraviolet light seems to be involved in the initial development in most cases, though not necessarily so. Irritants play an important role, as does the dry eye. Admittedly, this theory still leaves many questions unanswered. "Relatively mild" and "extended exposure" are terms indicating no precise information is available in these areas. The conclusion must be that although pterygiums have been described and studied for thousands of years, even with the most sophisticated instruments and methods available, a precise etiological theory has eluded us.

In order for optometrists to effectively use preventative treatment against pterygiums, it is necessary for them to apply the information just presented. We must know the many causative factors in order to prescribe the most effective preventive measure or combination of measures.

The first of three factors we will be dealing with is the dry eye, a significant condition in the cause and development of pterygiums. A moist chamber, which is often accomplished with goggles, allows greatly increased fluid equilibrium to exist between the eye and its surroundings. Therefore, the dry air often correlated with the occurrence of pterygiums
is no longer a major influence in drying out the eye. Since a dry eye often develops over many years, a moist environment may not be sufficient in and of itself. Artificial tears as a wetting agent can be used alone or in conjunction with a moist chamber.

Irritants are the second factor we will consider. Once again, the same two means of prevention are used, as mentioned above, but this time with different functions in mind. Instead of being used to keep moisture in, the chamber is used to keep irritating particles out of the eye. The artificial tears perform the function of flushing irritants out of the eye instead of wetting to prevent evaporation.

The third factor to be considered is ultraviolet radiation. Although we do not know the precise role ultraviolet light plays, it is certainly considered to be a contributor to the development of pterygiums. For this reason, precautions should be taken to protect the eyes from harmful radiation. Under normal conditions, a regular spectacle prescription will provide adequate protection. If a person spends a great deal of time near water or snow, such as a fisherman would, extra precaution is recommended. Because the eyes receive multiple reflections as well as direct sunlight, specially tinted spectacles or goggles would give the necessary added protection.

Although prevention is the preferred choice of treating a patient, this is not always possible. In these cases, correct management of pterygiums needs to be considered.

There are two important questions that the optometrist must face in
the management of pterygiums. They are: 1) What is the criteria for the referral of a pterygium for surgical treatment and 2) What type of surgical treatment should be recommended? These questions arise when optometric treatment and management are unsuccessful or when the patient is presented initially with an advanced pterygium.

The question of when should the optometrist refer the patient for surgery is answered with an established three-point criteria.

A. When the pterygium extends one and one-half millimeters into the cornea and is proliferative. Whether a pterygium is proliferative can be determined by the presence of edema in front of the head.

B. Pterygiums which are stationary but are causing astigmatism. If not removed, this pterygium could shrink causing additional traction on the cornea and produce even greater amounts of astigmatism.

C. If the pterygium is over one and one-half millimeters and stationary, the patient may choose to have it removed for cosmetic reasons.2

Surgical removal has always been the initial choice of treatment. Down through the centuries, a vast number of surgical techniques and postoperative therapies have been proposed and practised. In the early 1800's, simple excision alone was practiced by Scarpa. Later, a flap of neighboring conjunctival tissue was sewn over the bare area.1 At the turn of the century, McReynolds developed a technique in which the pterygium was excised from the cornea and then directed downward by suturing it to the inferior conjunctiva. A recurrence rate of 16% was reported at that time.16 Various types of grafts have been used to prevent recurrence.
These included skin grafts taken from under the upper arm as well as mucous membrane grafts taken from the mouth. The purpose of the grafts was to provide a barrier against vascular regrowth. Finally, the bare sclera technique has been used in which the subepithelial tissue is removed leaving the sclera exposed. This is most often used in conjunction with postoperative therapies.

Recurrence rates vary greatly from study to study but it has been estimated that surgery alone produces a recurrence rate of 20-60%. Therefore, a number of postoperative therapies were developed in order to help prevent recurrence. Chemotherapy has been tried using the agent triethylene thiophosphoramide (thiotepa). The purpose of this drug is to inhibit rapidly proliferating cells. One study reported an 8% recurrence rate and another 6% with little or no adverse effects. Others, however, reported scars and allergic reactions as well as the loss of lashes and lid pigmentation. Generally, this is not accepted as the method of choice. Cautery and cryopexy (freezing) have been used after surgery with some favorable results but others have argued that these methods will not stop the proliferation of some types of cells important in the recurrence of pterygiums.

Today most experts rely on beta-irradiation as the treatment of choice in most circumstances. There is a disagreement on two points, however. This is in the area of how large of a dose of radiation should be given and how soon after the surgery should the treatment begin. The lens absorbs approximately 15% of the radiation and a catarctogenic dosage is estimated to be when the lens absorbs 800 rads. This means a dosage of
5000 rads would be a borderline cataractogenic dosage. However, cataractous changes have been observed in patients receiving as little as 1400 rads, while others treated with 7000 rads showed no changes. Although Hilgers suggests 5000 rads as the optimum dosage, most researchers suggest 3000 rads or less to be administered in two or three dosages, while some use only 1000 rads or less. Hilgers suggests 5000 rads as the optimum dosage, most researchers suggest 3000 rads or less to be administered in two or three dosages, while some use only 1000 rads or less. Studies using radiation doseages of 3000 rads or less rarely have patients with any cataract development and report from a 3-0% recurrence rate.

General concensus among researchers has been that radiation therapy is most effective when it is begun immediately after surgery and no later than 24 hours postoperatively. This is because the capillaries are thought to begin growing again within 24 hours and safe dosages of radiation will not destroy already existing capillaries. However, in 1980, Cooper studied a sample of 272 pterygiums and reported that the recurrence rate among patients treated four days after surgery was less than half that among patients receiving their treatment before the third day postoperatively. The authors propose that the delay in therapy allows surgical effects to heal, making the tissue more sensitive to the treatment. Another possibility is that the recurrence mechanism becomes more sensitive to destruction by radiation after the fourth day.

Regardless of the dosage and treatment schedule employed in radiation therapy, the surgery of choice is the bare sclera technique. The entire pterygium must be removed as well as a one millimeter buffer zone beyond the head of the pterygium. This, of course, requires a keratectomy. The base of the keratectomy must be smooth so that cells can slide over
it in the process of regeneration. All conjunctival tissue is stripped away as far back as the insertion of the medial rectus with a minimal width of two millimeters. This allows the corneal epithelium to regenerate and reach the limbus before the conjunctival epithelium, preventing the conjunctival epithelium from invading the cornea. Radiation therapy is usually initiated within 24 hours using Strontium 90. Treatment is given in two or three doses, one week apart. Also antibiotic steroid drops are used in conjunction with the radiation treatment. If recurrence has not occurred within five years, the patient is generally considered to be cured.

Postsurgical optometric care consists of examining the patient periodically during the first year, twice during the second year and yearly thereafter. The patient should be seen immediately if he notices any changes in the surgical area or reports irritation. Similar preventative therapy should be administered in stopping recurrence as was initially used to manage the pterygium. Special attention should be given to keeping potential irritants out of the eye and to keeping the eye moist.

Our function as optometrists and primary health care providers should be the overall management of the patient's eye care. The optometrist should decide when a patient should be referred for surgical evaluation and which surgeon will provide the best care for each individual patient. The optometrist also manages the patient postsurgically and provides long term follow-up. Therefore, as with cataract patients, it is essential that the optometrist knows which surgeons are best qualified and what type of surgery and treatment they prefer. Using this in-
formation, it is possible to establish a good working relationship in which the optometrist retains the patient for follow-up care.

Complications have been seen to occur with pterygiums although there is no prevalent or consistent pattern. One study found particular changes in refractive error. Specifically, an increase in with-the-rule astigmatism was seen. In 46%, there was a change in astigmatism of more than 0.50 D and in 13% there was a change of 4.00 D or more. Although the refraction changed, pterygiums were not seen to cause visual impairment. Also, the central corneal thickness was measured and found to be normal.

One case was cited in which bulbar ligneous conjunctivitis followed the removal of a pterygium. It is not known how widespread or common this postoperative complication is.

Epithelial changes may be associated with the occurrence of pterygiums. For example, epithelial proliferation has been seen, although squamous cell carcinoma is rare. Further changes also occur in the stroma which result in an epithelial inclusion cyst. The cyst has been found both superficially and deep, usually causing a bump or elevation. Further complications may occur as the cyst can become infected.

We have covered considerable information concerning pterygiums and their characteristics. We have also discussed the very important role the optometrist should have in dealing with pterygiums. It is necessary for optometrists to be aware of this information in order to be able to use it in providing complete and proper care for their patients.
FOOTNOTES

1 Malcolm E. Cameron, Pterygium Through the World (Springfield: Thomas, 1965)


8 V. Dolezalova, "Is the Occurrence of a Temporal Pterygium Really So Rare?" Ophthalmologica, 174(2) (1977) 88-91.


33 H.A. van den Brenk, "Results of Prophylactic Postoperative Irradiation in 1,300 Cases of Pterygium," Amer J Roentgen, 103 (August 1966) 723-33.


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