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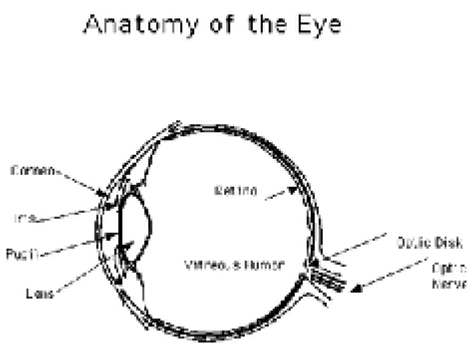
HOW WE CAN SEE......

Renju Sajan
PHC Vellangallur

From the beginning humans have tried to explain the complex process of vision.Vision is a complicated process that requires numerous components of the human eye and brain to work together. The *initial* step is carried out in the retina of the eye. Specifically, the photoreceptor neurons (called photoreceptors) in the retina collect the light and send signals to a network of neurons that then generate electrical impulses that go to the brain. The brain then processes those impulses and gives information about what we are seeing.The main structures of human eye include the iris, lens, pupil, cornea, retina, vitreous humor, optic disk and optic nerve.



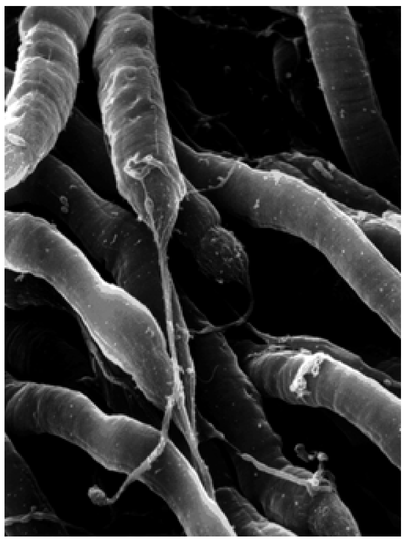
By 19th century Thomas Young, a prominent physicist and physician, carried out a number of studies on the eye that resulted in an understanding of how the lens focuses images onto the retina. He also showed that astigmatism results from an improperly curved cornea. We now understand that a number of vision disorders, including both near- and far-sightedness, also result from an improperly curved cornea. The lenses in eyeglasses function by correcting for the improper corneal curve.

We now know the basic function of the components of the human eye and how they participate in the vision process. Light that reflects off of objects around us is imaged onto the retina by the lens. The retina, which consists of three layers of neurons (photoreceptor, bipolar and ganglion) is responsible for detecting the light from these images and then causing impulses to be sent to the brain along the optic nerve. The brain decodes these images into information that we know as vision.

Rod Cells and Cone Cells of the Retina

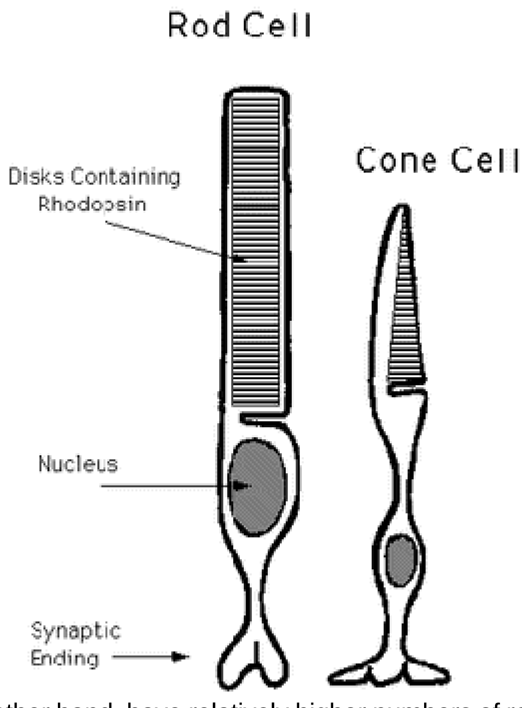
Although the microscope was first used in scientific observation in the late 16th and early 17th centuries, both the tool and the techniques of its use reached a sufficient level of sophistication by the 19th century to make it invaluable in examination of the structures of the eye. It was in the 1830's that several German scientists used the microscope to closely examine the retina. During this time that two different cells were discovered in the retina, the rod cells and cone cells. These cells were named because of their shape as viewed in the microscope.

A microscopic view of the rod cells of a zebrafish shows us how these cells actually look in an animal. Additional research showed that the rod and cone cells were responsive to light. Max Schultze (1825-1874) discovered that the retinal cones are the color receptors of the eye and the retinal rod cells while not sensitive to color, are very sensitive to light at low levels. Selig Hecht showed, in 1938, the exquisite sensitivity of rod cells when he showed that a single photon can initiate a response in a rod cell. Cone cells on the other hand are less sensitive to light but show great sensitivity to different colors. It is the cone cells that allow us to see in color. It is because cone cells remain unstimulated in low light



environments that we do not see color in dimly lit places. Try this for yourself. Go into a closet and decrease the light level. Soon you will see only shades of gray. Slowly increase the light levels until you can begin to see color. This demonstration usually works well in a closet because of the many different colors of your clothes.

In the human eye, there are many more rod cells in the retina than there are cone cells. The number of rod cells and cone cells in animals is often related to the animal's instincts and habits. For example, birds such as hawks have a significantly higher number of cones than do humans. This let them to see small animals from a long distance away, allowing them to hunt for food. Nocturnal animals, on



the other hand, have relatively higher numbers of rod cells to allow them better night vision.

A schematic drawing of rod and cone cells are shown above.cells are divided into two sections. The bottom portion is called the inner segment. It contains the nucleus and the synaptic ending. The synaptic ending attaches to the neurons which produce signals that go to the brain. The top portion is called the outer segment. The outer segment is comprised of a membrane which is folded into several layers of disks. The disks are comprised of cells that contain the molecules that absorb the light.

Visual Pigments

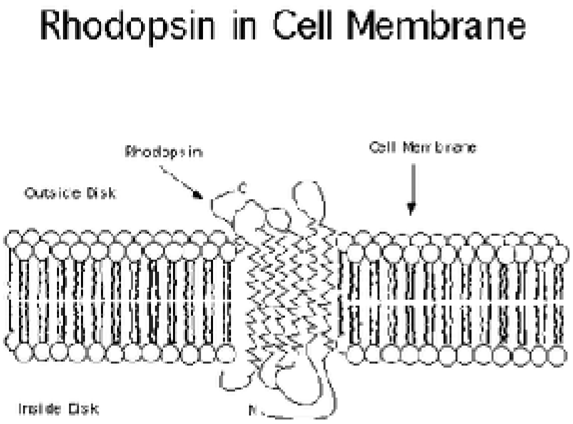
During the 1800's the visual pigments were discovered in the retina. Scientists, working by candlelight, dissected the retinas from frog eyes. When the retinas were exposed to day light they changed color. These scientists had discovered that the retina is photosensitive. They realized that the color they were observing was due to presence of a visual pigment, which was given the name rhodopsin. Later studies showed that rhodopsin is a protein that is found in the disks of the rod cell membrane.

Pigments are also found in cone cells. There are three types of cone cells, each of which contains a visual pigment. These pigments are called the red, blue or green visual pigment. The cone cells detect the primary colors, and the brain mixes these colors in seemingly infinitely variable proportions so that we can perceive a wide range of colors. Prolonged exposure to colors, for example when staring at a particular object, can cause fatigue in cone cells. This results in a change in the way that you perceive the color of the object that you are viewing.

The original theory of color vision was introduced by Thomas Young around 1790, prior to the discovery of the cone cells in the retina. Young was the first to propose that the human eye sees only the three primary colors, red, blue and yellow and that all of the other visible colors are combinations of these. It is now known that color vision is more complicated than this, but Young's work formed the foundation of color vision theory for the scientists that followed. The photoreceptor proteins of the cone cells have not yet been isolated. This may possibly be due to the difficulty in obtaining them. There are many fewer cone cells than rod cells in the retina. Also many animals do not have cone cells and hence do not see in color.

An Important Protein in the Rod Cell: Rhodopsin

George Wald and his coworkers at Harvard University pioneered our understanding of the molecules responsible for the first steps in the vision process. For this and other work on vision he was the recipient of the 1967 Nobel Prize in Medicine and Physiology. Wald's group was the first to elucidate the molecular components of the rod cell's functional protein rhodopsin. Prior to his work, rhodopsin was thought to be a chunk of molecular



material. Wald and his co-workers determined that the protein consists of two molecular parts: a colorless amino acid sequence called opsin and a yellow organic chromophore called retinal.

It is now known that the rhodopsin protein has a molecular weight of ~40 kDa. The protein spans the membrane of the rod cell, and is therefore called a trans-membrane protein. The exact structure of rhodopsin has never been determined, however experimental data lead scientist to predict that it contains seven helices or turns. About half of the protein is contained within the membrane with approximately 25% of the protein lying both above and below the membrane.

It is the rhodopsin protein in the retina that absorbs the light that enters the eye. Specifically, it is known that the retinal molecule, which is embedded inside rhodopsin, undergoes photo-excitation by absorbing light. In the photo-excitation process, the rhodopsin absorbs light and is excited to a higher electronic state. Numerous studies have been carried out to try to understand what happens after the rhodopsin absorbs light. Research has shown that upon photo-excitation the retinal part of rhodopsin undergoes a twisting around one of its double bonds (see Figure 4). The retinal then dissociates from the opsin. The change in geometry initiates a series of events that eventually cause electrical impulses to be sent to the brain along the optic nerve. Further research is needed to fully understand this complex process.

Vitamin A and Retinal

During the early part of the 20th century work continued on the frontier of research aimed at understanding vision. It was also around this time that the relationship between vision and proper nutrition began being studied at universities and agricultural schools. It had been shown during World War I that a vitamin A deficiency caused night blindness. The link between vitamin A and night blindness, however, did not become clear until George Wald and his coworkers isolated vitamin A from the retina in 1933. Prior to this finding the importance of vitamins was poorly understood. Additionally, the complete role of vitamins in physiological processes was unknown.

It is now understood that the human body makes retinal from vitamin A. A picture of retinal and vitamin A is shown in Figure 5. Both the retinal and vitamin A molecules contain a long chain of double bonds. When retinal dissociates from opsin, some of the retinal is destroyed. To replenish the destroyed retinal, it is important to have a source of vitamin A in your diet. Without this source of vitamin A, night blindness can develop as the rods can not function effectively without sufficient sources of retinal.

An eye for an eye makes the whole world blind.

Mahathma Gandhi

Spectacle Lens Manufacturing

From Casting To Freeform Generation

Many different lens manufacturing techniques have been used over the decades, some of which have now been abandoned. They can, however, be divided into four basic types:

1. **Casting,** where a finished or semi-finished lens is produced from raw chemicals using a chemical process (e.g. CR39 casting)

2. **Moulding,** where the lens material exists and it is reshaped by pressure and heat into the finished or semi-finished lens form (e.g. polycarbonate injection moulding)

3. **Multi-part systems,** such as laminating and fusing, where two or more pieces are joined to form the final lens (e.g. fused glass bifocals)

4. **Surfacing,** where the lens materials already exist and cutting and/or grinding and polishing is used to create the lens form (e.g. Rx surfacing)

Many lenses are produced by combinations of these four processes, the most common being the mass manufacture of semi-finished resin (e.g. CR39) by casting, followed by surfacing in an Rx laboratory to produce the second surface. Glass lenses are, of course, first moulded roughly to shape and then surfaced on both sides.

Casting

Casting is the most common lens production method in use today. It consists of plac-ing some chemicals (e.g. CR39 monomer plus a chemical catalyst) between two glass (or metal) moulds held apart with a flexible gasket, and then subjecting it to heat (or UV energy). The material cures by polymerisa-tion of the monomer into a polymer. An ini-tial supply of energy is required to start the process, but then the polymerisation exotherms and cooling is sometimes required to prevent overheating. (Exotherm means that heat is created during the chemical polymerisation process.)

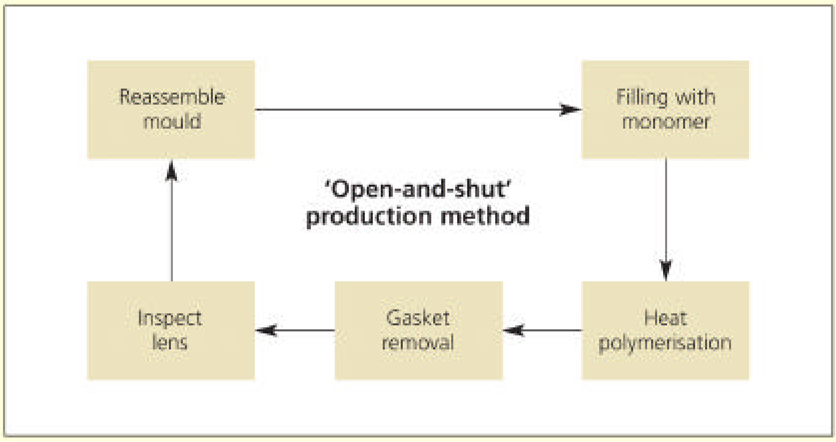


Fig 1 Lens Casting Process

Because the material exotherms from the centre, this technique is difficult to use for thick lenses because of poor heat transfer through the lens itself.

During the conversion from monomer to polymer, the material shrinks (typically by 14%). About half of the shrinkage occurs while the chemicals are still liquid, and this necessitates a flexible gasket between the two mould surfaces. However, a bigger problem occurs during the second half of the polymerisation, because the lens material is then fairly rigid. For lenses where there is a big difference between the thickness of the edge and the thickness of the centre of the lens, the front and back moulds, and/or the lens, must bend to prevent separation between lens and mould causing a reject. Obviously, this causes difficulties when cast-ing high powered lenses.

Some companies have now replaced the spring and edge gasket with an edge taping system. The CR39 monomer is injected into the mould cavity either at the edge of the gasket or through the edge tape, and a small gap allows any air to escape. Bubbles can easily be left within the mould and hence lens curing is done with the lenses posi-tioned, so that any remaining bubbles are at the edge of the lens blank rather than in the centre.

Although many lens casting processes use air to heat (and cool) the moulds, some manufacturers use water baths because of improved heat conduction. With a typical curing cycle of about 18 hours, many lens mass manufacturing casting production processes are worked on a 24-hour cycle on what is called an 'open-and-shut' system. It is very difficult to inspect moulds for surface defects, but relatively easy to inspect finished lenses. Operators open the moulds, remove the new lens, inspect it for defects and if there are none, immediately close the mould ready to manufacture another lens. This is, of course, done in an ultra-clean environment. The process is illustrated in **Figure 1,** with a photograph of the components of a mould assembly shown in **Figure 2.**

Lens casting is primarily a mass manufac-turing process but many attempts have been made to cast lenses to prescription. This has not proved commercially successful. The biggest problem (in the view of the author) is that to the uninitiated person, lens casting looks so incredibly simple; you just fill the mould, heat cure and remove the lens. In fact, it is far from easy, with high reject rates for the very lenses that are required for spectacle prescriptions. As an example of this problem, the author was once told that the reject rates in a factory were linked to the square of the lens power, for example, pianos had almost no rejects, 3.ODD lenses had a 9% reject rate, 6.00D lenses a 36% reject rate

Figure 2 Compnents used for lens casting - Flex-ible gasket, spring clip, top & bottom glass moulds

and 9.00D lenses a 81% reject rate.

Since the problems with casting relate to the thickness of the lens, some interesting ways of making prescription lenses have been attempted. For example, the Innotech Company took what were essentially fin-ished single vision lenses and then cast onto the front surface a thin multifocal/progressive segment. Being very thin, this could be done very quickly. In principle, this was a clever idea and some units were sold in the US. Apart from the production difficulties, the growth of AR coating has virtually eliminated the market for in-practice lens casting systems; if the lens has to be sent away for coating, then the lens production might as well also be done by the coating company. In fact, this is also sensible because full knowledge of the lens material and its method of manufacture can prevent problems in the coating process.

Moulding

By moulding (compared to casting) we mean 'reforming' using pressure and heat. Originally used to create glass blanks (for later grinding and polishing) moulding is now more commonly used to create polycarbonate lenses (remember that polycar bonate is a thermoplastic material, whereas CR39 is a thermosetting resin).

The first stage of the process is for a chemical company to produce the polycarbonate material, usually in granular form. These granules are then put into an injection moulding machine, heated and then injected under pressure into a mould cavity. Rather like casting, lens moulding is difficult for high power and thick lenses due to shrinkage as the newly formed lens cools. This can be alleviated by complex modern machines, which inject and then compress the lens as it is cooling and solidifying. Typically six or more lenses are produced at the same time, all connected by the 'sprue' - the path along which the material is injected

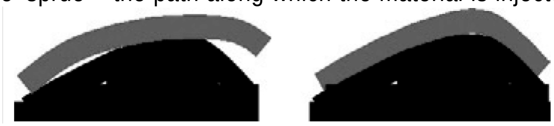


Figure 3 The Glass Slumping Process

into the mould. As all thermoplastic lenses are soft and need hard-coating, this sprue is often used to hold a group of lenses during a dip-coating process.

Another moulding process, only used by mass manufacturers, is called 'slumping'. This process is usually only used in the manufacture of semi-finished progressive power glass lenses, and is best illustrated in **Figure 3.** First a ceramic block is produced using a 3D, numerically controlled grinding machine with the top side in the form of a progressive power lens. A polished parallel sided piano glass blank is then laid over the ceramic block and subjected to a carefully controlled heat process, sufficient to allow the glass to bend but not to melt. This must be done in a clean and dust-free oven to prevent contamination of the upper surface (although dust covers are also used). After the heating process, the lens (with its finished progressive front surface) is removed from the ceramic block. This semi-finished lens then undergoes the normal Rx surfacing of the rear surface. A similar system is now used to produce glass moulds for later use in casting thermosetting plastic (CR39) progressive power lenses.

Multi-part

There are a number of different multi-part processes. Probably the best known is the method used to produce glass bifocals by fusing a segment with a different refractive index to make the reading addition section of the lens. **Figure 4** shows diagrammatically how this is done for a flat-top bifocal. Another multi-part system is the combination of two thin laminates to form a finished lens using a system called 'Instalens' (Polycore Optical). It is intended for use by practices with small optical laboratories who want to produce multifocal and progressive prescription uncut lenses within a few minutes. A small stock of laminates is required. White and photochromic materials are available, with and without coatings, in bifocal and progressive lens forms. Essentially, the multifocal front laminate is glued (using UV) to a rear laminate containing the distance prescription. In principle, this is a clever method that permits the rapid

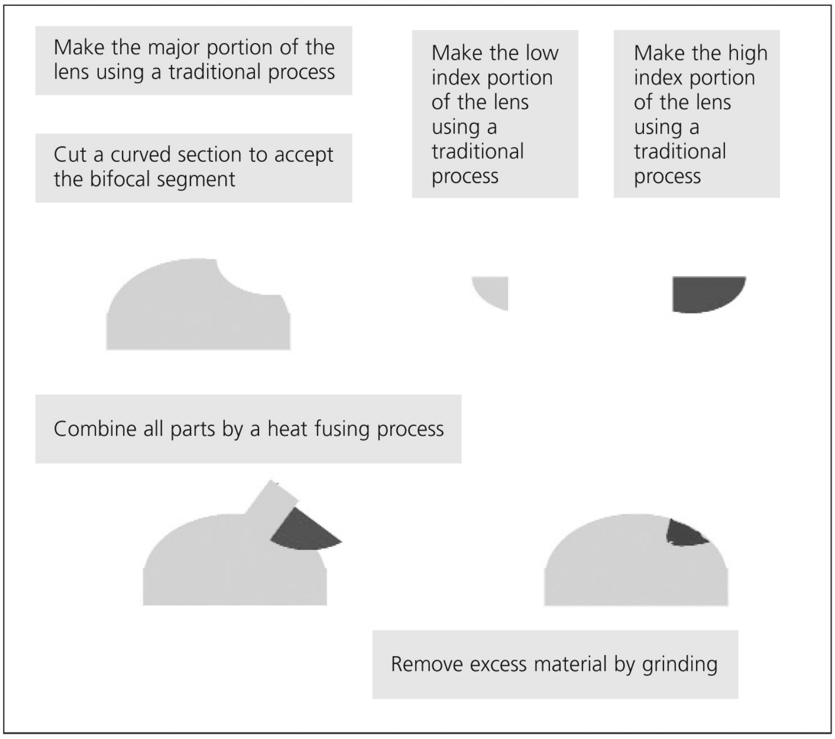


Figure 4
The manufacture of glass multifocal lenses by fusing

in-practice manufacture of finished coated lenses. The cost of stockholding the large numbers of component front and back laminates is the major difficulty. The production cost is relatively high because what are essentially two lenses are required to make each finished lens. There are some other spectacle lenses produced by laminating, such as laminated safety lenses, polarising lenses and diving goggles.

Surfacing

Surfacing is the most common lens manufacturing technique (with the possible exception of mass production casting of single vision uncut lenses). There are three main types of surfacing processes, although with many variants for special applications particularly in relation to the production of progressive power lenses. They are:

- **Rough grind, smooth and polish,** where all processes involve a lapping tool. Modern systems usually do the initial roughing stage using a lapping tool with a diamond abrasive embedded into a metal matrix. This system is only used in large volume glass production processes because it requires separate grinding, smoothing and polishing laps for each curvature

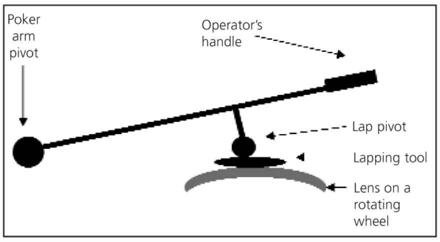
- **Generate, smooth and polish,** where a cup-shaped cutting wheel is used to gen-erate a spherical or toroidal curve, followed by lapping tool smoothing and polishing. This is the method used in most prescription laboratories. Again, different smoothing and polishing laps are required but a common machine is used for the grinding stage

- **Cut, smooth and polish,** where a single point cutter is used in a process usually referred to as 'freeform'. This is particularly applicable to progressive lens surfaces. After single point cutting, the surface can be smoothed and polished in the same way as if a cup-wheel generatorhad been used. However, current developments are aimed at omitting the smoothing stage

Rough grind, smooth and polish

This is the oldest system in existence. Apart from the use of an electric motor to rotate the lenses against the grinding tool, Leonardo da Vinci would have fully comprehended any modern process of grinding, smoothing and polishing a lens surface. A poker arm machine is the most basic version, and is illustrated in **Figure 5.**

Figure 5
Poker arm grinding machine



At each stage, finer and finer materials are used working on a ratio of about 10:1 between stages. For example, the first process is to obtain a rough shape by the removal of about 2mm of glass using a 0.2mm diameter grit. This leaves imperfec-tions in the surface of about 0.2mm. The second stage removes about 0.2mm using 0.02mm abrasive, and leaves imperfections of about 0.02mm. The final polishing stage usually removes about 0.02mm, using 0.002mm abrasive and leaves a surface with 0.002mm imperfections (0.002mm = 2 microns). Since the eye cannot see individ-ual particles less than about 20 microns, the resulting surface appears highly polished.

There are many clever techniques used in production to ensure that the correct curvature of the surface is achieved. For example, the lapping tool always oscillates so that a constant curvature without surface waves is obtained, the radius of curvature can be gradually decreased by preferentially oscillating towards the edge of the tool and vice versa. More accurate curves can be achieved by multi-blocking a number of lenses onto a large ‘block’, and true flats can be achieved by interchanging three flat tools.

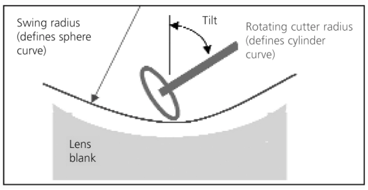
Production systems for the mass manu-facture of spherical glass lenses using the rough grind, smooth and polish process usually start with a tool that has fine dia-mond particles embedded into a metal bond. The author introduced a system using this method into a UK Optical factory over 25 years ago. It enabled 30-second grind-ing, 30-second smoothing and two-minute polishing to be achieved on spherical glass lenses where one operator produced a finished lens every 30 seconds from a bank of 12 machines (a grinder, smoother and four polishers for the convex surface and the same for the concave surface).

This system of using lapping tools for all stages is only suitable for mass production because of the large investment required in tooling. Most surfacing production uses a generation stage (see next), in which one machine can be adjusted to generate differ-ent curves as described in the next section.

Generate, smooth and polish

The key component of a generate, smooth and polish system is the generating machine. This usually consists of a tubular shaped ‘cup-wheel’ rotating cutter with a curved end, as illustrated in **Figure 6.** The cutter is mounted on a swinging arm and can be tilted so that the combination of swing and tilt can produce the two different curves of a toroidal surface.

» **Figure 6**
Illustration of how a generator cuts a toroidal surface



Cutting with a tilted circular cutter does not actually produce a circular cut, but an elliptical curve. The elliptical error is not large enough to be significant to the optical power of a lens, but can be significant to the manufacturing process. It should be remembered that the smoothing and polishing tools may be accurate circular shapes, or may have been produced using a process that also involves elliptical errors. It is the discrepancies between the elliptical curvatures of the generation, smoothing and polishing tools that may cause some difficulties in the lens making process (see *later).*

» **Figure 7**
A lens generator *(by courtesy of Norville Autoflow)*

The key part of a generate, smooth and polish process is the generator itself. Very old machines had to have the radii of the two curvatures set manually before the cutting commenced, although this is now done automatically through electronic controls. **Figure 7** shows a typical ‘conventional’ lens generator.

When a generator is combined with some smoothing and polishing machines, it cre-ates a prescription lens manufacturing system suitable for a small Rx laboratory. Such a laboratory requires not only the generator, smoothing and polishing machines, but also a rack of lapping tools, a blocking and de-blocking unit and other ancillary equipment.

A considerable inventory of lapping tools is required to produce the combination of spherical and cylindrical curves commonly used in a prescription laboratory. At the very least, tools for every quarter dioptre, from perhaps piano to 12.ODD curves with zero to 6.00 cylinders - not an inconsiderable number is required. Because of the wide variety of different refractive index materials now in use, many more tools, normally in eighth dioptre increments are required, as well as a few tools of each sphere and cylinder combination. To prevent damage and wear to the accurate tool curves, a system of applying replaceable abrasive and polishing pads onto the same tool has been evolved. The pads have a special shape to allow them to adapt to the curvature of the tool.

Other techniques, where for example the polishing stage is replaced by lacquer coat-ing, have been created and these are described later in the section on recent developments.

Mention should also be made here of the number of smoothing stages. With modern equipment, it is usually possible to go from generating to polishing with only one smoothing stage, but historically two stages of smoothing were often used. Obviously there is a trade-off between the amount of material removed and the smoothness of the surface. Remember that sufficient material must be removed to clear surface cracks and curvature inaccuracy (including elliptical errors) left by the generating stage. Advice on the choice of smoothing and polishing pads is freely available from the suppliers of prescription laboratory consumables, who can provide complete systems as a turnkey operation, including operator training.

In addition to the generating, smoothing and polishing machines, many other pieces of equipment are needed to complete the surfacing process, including lens tool calculation, lens surface protection, blocking and de-blocking, etc.

The first essential is to calculate the curva-ture of the lens surface to be produced. This requires knowledge of the semi-finished curvature, the material refractive index and the desired lens power. For plus power lens-es, a knowledge of the frame shape is also required so that the thinnest possible uncuts may be produced allowing just sufficient thickness at the critical point around the circumference. For aspheric and progressive power lenses, prism thinning may also be required to produce the best balanced lenses. The computer software to carry out these calculations is complex, but is available from the surfacing machinery suppliers. Having calculated the surfacing require-ments, the next stage is to select the semi-finished blank, protect it with surface saver tape **(Figure 10)** and then mount it onto an alloy block. Ready blocked lenses, together with the lens calculation computer printout, are then placed into a work-tray**.** The lenses then go through the generating, smoothing and polishing stages, are de-blocked and inspected.

Figure 10
Surface saver tape and taping machines
(by courtesy of Norville Autoflow)

Cut, smooth and polish

Using a traditional cup-wheel generator restricts the shape of the surface (ignoring elliptical errors) to either a sphere or to a toroidal section, the latter being of course two circular arcs at right angles to each other.

The key difference between a 'generated' curve and a 'cut' curve is that the latter is produced by a single point cutter, and hence elliptical errors can be eliminated. A single point cutting tool has one big advantage (and a big disadvantage). In its favour is the ability to cut any curve, even a com-plex progressive or aspheric, or even a com-bination of these. The disadvantages are the cost and complexity of the machinery, that it can take much longer for the whole sur-face to be cut, and also it is difficult to avoid a 'pip' at the central point of the cutting action. Remember that a single point tool is only cutting one point at a time, whereas a generator is cutting a whole section or arc at the same time.

When cutting a non-spherical curve, a single point cutting tool needs to oscillate at right angles to the lens surface. For a toric curve, this requires two in-out oscillations per lens revolution. This requires great accuracy and can involve considerable inertia forces. The cutter should therefore be as light as possible, but must be very rigidly mounted. The faster the lens rotation speed, the greater are the inertia forces, and it is this which may limit the total cutting time.

Figure 12a
Initial stage freeform cutting
(by courtesy of DAC International)

Figure 12b
Finish stage freeform cutting
(by courtesy of DAC International)

A close-up of a lens cutting tool is shown in **Figure 12. Figure 12a** shows the rough cut tool, and **Figure 12b** the fine cut tool. Oscillation of the tool presents considerable technical challenges due to the wear in mechanical parts. At least one machinery company has developed an air-slide mounted diamond tool assembly to minimise fric-tion and machine wear, and also a 'voice-coil' driven oscillation system thereby eliminating electro-mechanical motions.

The development of numerically con-trolled 'freeform' surface cutting machines means that it is now possible to produce one-off prescriptions for progressive power lenses allowing for an individual's personal requirements including facial features, different distance and reading PDs, different lengths for the corridor between distance and reading optical centres and other factors. Considerable computing power is required to calculate the motion required from the cutting tool as the lens rotates, so a powerful computer is necessary.

There is of course another major problem associated with a freeform surface shape and that is how to smooth and polish it. This problem was overcome many years ago when glass progressives were first pro-duced. One system was to carry out the smoothing using a very small diameter flex-ible diamond pad, although this was of course a slow process. The polishing was then done on what was called a 'drum' pol-isher. This consisted of a polishing material stretched across what looked like a drum, with compressed air underneath the materi-al so that it flexed to take up the progressive shape of the surface. Inevitably, flexible smoothing and polishing causes some degradation of the desired/designed surface (making it less undulating) but nevertheless a satisfactory product can be produced.

» Figure 13
Soft lap polishing tools
(by courtesy of DAC International)

Also available are flexible soft-lap 'balloon' polishing tools **(Figure 13,** which shows three soft-lap tools which between them cater for all of the curvatures required). Inevitably, some accuracy is lost and so the smoothness of the cutting action is crucial to the viability of the whole process. The finer the cut surface, the less smoothing is required, and hence less distortion occurs to the desired surface shape. In **Figure 12,** two cutting tools can be seen, one used to roughly shape the surface and the other to create a finer surface. This two-stage single point diamond cutting reduces the amount of polishing required.

Many other methods have been tried, but the current favoured option is to use a hard-coating lacquer to convert a smoothed surface into what looks like a polished surface. While it is still not possible to go directly from cutting to hardcoating, this will no doubt become possible in the future in what may be called a 'cut-and-coat' process.

The ability of hardcoats to disguise minor defects (where very minor blemishes on lens surfaces can be 'filled-in' with a lacquer) is already used in large production operations resulting in a higher production yield. Obviously major defects cannot be corrected - but very small defects can be disguised resulting in a satisfactory final product.

Future developments

While the mass production of single vision lenses is likely to continue much as before, mainly by using casting and moulding processes, the future for prescription lenses is more difficult to predict. Many attempts have been made to develop new processes, cast to Rx, front surface casting, laminating, etc. Most people think that the ultimate goal is the aforementioned cut-and-coat process. However, with a high percentage of lenses now requiring an AR treatment, it is the AR coating that may in future become the major delay in the manufacture of a prescription lens.

Large, complex high volume coating machines are now required to produce the latest generation of modern coatings, which include hydrophobic and oleophobic properties, and it is logistically difficult for these to produce prescription lenses rapidly. The future of lens manufacture therefore needs a breakthrough in coating methods if delivery time is to be reduced. The production of a dip-coated, single layer AR coating has been attempted and although this would reduce costs, it seems unlikely to succeed commercially because of the current requirement for multi-layer AR coupled with a hydrophobic topcoat.

Front-side coated, semi-finished lenses have also been produced. This means that only one side needs to be AR coated after surfacing, reducing the production time. This development was done as a collaboration between a machinery company and a one-hour optical chain, which intended to use a small four-lens AR coating machine needing only 15 minutes for the plasma sys-tem coating process.

It now seems that the way forward for surfacing may become the cut-and-coat system using lacquer hardcoating, but this does not resolve the problem of rapid AR coating to the modern sophisticated stan-dards. Perhaps a dual market will evolve, with rapid relatively low cost production of less complex products in parallel with longer time scale, higher cost sophisticated lenses.

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The Portals

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Medical Officer
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Diseases have been affecting humans from antiquity. An early diagnosis reduces morbidity from such diseases and cost incurred in treating them. There has been a paradigm shift in profile of diseases in ophthalmologic perspective; from infectious diseases to non communicable diseases like diabetes, hypertension etc at least in our state. Though infectious diseases like conjunctivitis, infectious keratitis are common in community, they are rarely misdiagnosed and most patients are treated appropriately and early. But same is not the case with noncommunicable diseases; they may not be diagnosed early as rarely they are symptomatic enough to merit any investigations and late diagnosis leads to morbidity in such diseases.

Though a physician may be competent enough to diagnose such noncommunicable diseases early from certain visible signs but he may not get enough time to properly examine a patient and thus early diagnosis is missed. So, how can a ophthalmic assistant help in this regard? They can bring visible signs indicative of internal diseases to attention of treating physician & there by helping in early diagnosis. As eyes are windows through which mind sees the world, eyes can be a portal to visualise derangments within the body.

Xanthelesma are multiple yellow thickenings seen over medial aspect of eyelids which if especially seen in young people may be marker of increased cholesterol in body. Trichomegaly meaning excessive eyelash growth is seen in malnutrition, hypothyroidism, with certain drug intake, AIDS, porphyria. Madarosis meaning decreased number of eyelashes may be due to myxoederna [severe hypothyroidism],psoriasis, leprosy,systemic lupus erythematosus [disease in which body's immune mechanism turn's against itself & includes symptoms like joint pain, skin rash etc] & chronic anterior lid margin disease. Upper lid retraction meaning lid at or above level of superior limbus may be seen in hyperthyroidism, parkinsonism, uremia [advanced stage of kidney problem] & in some other neurological problems, keratoconjunctivitis sicca meaning dry eye is seen in elderly, contact lens users, people working for long time in AC, parkinson's disease, atopic keratoconjunctivitis, posterior blepharitis, severe proptosis & many autoimmune conditions like rheumatoid arthritis, SLE etc. Seemingly harmless subconjunctival hemorrhage may be rarely sign of diseases like scurvy, blood diseases, malaria, elderly people with hypertension etc.Arcus if present below age of 40 years may be sign of high cholesterol. A ring similar to arcus called KF ring may be seen in cornea in a disease called wilson's disease [a disease in which copper excretion from body is defective]. Early in disease it may be seen only in one part of cornea especially superiorly. Cataract [sunflower cataract] may be seen in this disease at an early age.

Signs seen in diabetes include iridopathy detected as increased iris transillumination, unstable-refraction, recurrent styes, xanthelesmata[multiple yellow thickenings seen over medial aspect of eyelids], accelerated senile cataract or even acute onset cataract rarely, ocular motor nerve palsies [pupil sparing third nerve palsy may be see] & reduced corneal sensitivity. Key retinal features in diabetes include microaneurysms, retinal hemorrhages [dot & blot], retinal lipid exudates, cotton-wool spots, macular edema, neovascularization, vitreous hemorrhage, retinal detachment & neovascular glaucoma.. Lid retraction, chemosis, proptosis, superior limbic keratoconjunctivitis, keratoconjunctivitis sicca and diplopia are few signs that may be associated with hyperthyroidism. Dry eye, scleritis, ulcerative keratitis are a few external eye signs seen in rheumatoid arthritis. Dry eye, scleritis, madarosis, peripheral ulcerative keratitis may also be seen in systemic lupus erythematosus [disease in which body's immune niechahism turn's against itself & includes symptoms like joint pain, skin rash etc].' Eye features suggestive of atopic eczema include madarosis, staphylococcal blepharitis, chronic keratoconjunctivitis, keratoconus & early onset cataract. Signs of various forms of allergic conjunctivitis include papillary hypertrophy on superior tarsus, mucus deposition in between papillae, discrete white spots near limbus, punctuate epithelial erosions, local area of arcus adjacent to allergic area [called pseudogerontoxon],peripheral superficial vascularisation, conjunctival congestion predominantly in interpalpebral area, angular fissuring & scaling.

A discussion of this sort is not complete without mentioning about AIDS. Ocular features includes blepharitis, multiple molluscum lesions[palunni], herpes zoster ophthalmicus, orbital cellulitis, conjunctival microangiopathy, skin cancer of eyelids & conjunctiva, keratitis especially by unusual organisms, dryness of eyes, retinal necrosis & retinitis from unusual organisms. An eye sign seen in chronic depression is Veraguth's fold. It is a triangular fold of skin seen in the nasal corner of upper eye lid and is pathognomosic for it.

Finally a word of caution; the above mentioned signs in isolation are not absolutely specific for a disease but rather it is the constellation of many signs along with symptoms that are important in diagnosis of any disease.

After Care Of Contact Lens

Binoy R
CHC Anchal

First After Care Visit

The first after care visit should takes place after two weeks. Generally all patients may complain of genuine adaptive symptoms. Daily wear patients should be examined during the afternoon following several hours of contact lens use where as if the patient is wearing the lens overnight if the effects should be observed in the morning.

Initial discussion

The initial discussion should cover many points like whether the patient feels comfortable with the lens ,any particular problems facing , maximum wearing time, whether handling satisfactory ,are instructions being followed, solutions are being used correctly, whether the soft lens is inside out etc. Examiner should carefully distinguished between visual and physical symptoms.

Visual Acuity and Over Refraction

Snellen' visual acuity are recorded monocularly and binocularly in the normal way. The quality of retinoscopy reflex is important during assessment of vision and over refraction.

Fitting Assesment

The following things may be noted with white light usually a torch in case of soft lenses.

1.Lens centration in primary position
2.Lens movement on blinking
3.Lens position with lateral and vertical movement.
4. Blink rate
5. Conjunctival injection
6. Head position
7. Eye movements.
8. Palpebral aperture.

Hard Lens

Assessment OF fitting of hard lens should be done with fluorescein. The flourescein examination should reveal the following,\.1.The central fitting in respect of touch and clearence.2.Peripheral fitting and edge clearance.3.The speed of flourescein mixingas an indication of tear flow.4.three and four o clock staining.5.Other areas of corneal staining or desiccation.

Slit lamp examination with lens in situ is done to asses lens fit and to determine the gross corneal

Oedema, bulbar conjunctiva for signs of vessel irritation, the condition of lens, air bubbles trapped under the lens, debris trapped under the lens and wettability of lens surface etc,

Slit Examination With Lens Removed

The lenses are removed and stored in patients own case. Flourescein instilled and the eyes are examined for any corneal staining, eodema, foreign body and qualitative assessment of tear film

After careful examinations the practitioner is now able to decide whether the symptoms are adaptive for some actions like alteration of power or fitting or refitting with different materials, use of different solutions or adjustments of wearing schedules are needed. Reassurance concerning any subjective symptoms should be given. Recommend date of next visit.

Visual Problems

Distant and near acuity should be assessed separately. Contrast sensitivity measurements may explained visual problems where recorded acuity appear to be satisfactory. Retinoscopy reflex is an important diagnostic aid. It can show optical aberrations in a lens because of poor manufacture. A retinoscopy reflex improving after a blink with a soft lens indicate tight fitting. Spectacle blur may be expected with PMMA lens.

An apparently unequal change in over refraction is an indication that the right and left lenses have been reversed.

Non Adaptive Problems

An increase in minus power may indicate corneal oedema. Residual astigmatism can cause blurred vision. Foggy vision occur due to greasy lens. Asthenopia may be due to residual astigmatism. Over refraction, binocular imbalance or change in eye dominance (because of residual astigmatism in the dominant eye). Variable vision worse after blink suggest a loose fitting. Deterioration of vision during the course of the day may be due to a lens dehydration.

Wearing Problems

Oedema is common with PMMA and in soft lens with hypoxia. Microcyst and bullae are other signs of corneal swelling. Subjectively patients may complaint of photophobia, cloudy vision or spectacle blur

· Staining : Arcuate staining with hard lenses found in the superior mid-periphery of the cornea. Staining can be caused by
1. Poorly finished edges,
2. Insufficient edge by a sticky lens,
3. Tight fit with excessive forced blinking,
4. Blocked fenestration,
5. Deposit on the posterior lens surface.
·
3 'O' clock and 9'O' clock staining
·Central Staining.
·Punctate staining
·
Foreign body: Foreign body under the lens cause pain and corneal scare

· Air bubbles (Dimpling): Small air bubbles trapped in a pool of tears beneath a contact lens act as a foreign body. If the lens is removed and the eye rinsed with saline, irregular depression can be seen in the corneal surface. It cause blurred vision if it occurs within the papillary area. It can be helped by loosening the fit to promote better tear flow, changing BOZD or total diameter.

Limbus

It is important to examine the limbus since the limbal vessels dilate in response to any adverse stimulus such as physical irritation, insufficient oxygen or solution reaction.
Staining at the limbus can occur in following reasons.

- Solution reaction
- Abrasion from lens edges
- Dessication
- Hypoxia beneath upper lid

Dellen

Marked corneal thinning at the limbus associated with severe conjunctival injection is called dellen.

Bulbar Conjunctiva

Minor degree of redness is frequently adaptive. Severe conjunctival injection is due to
- Solution reaction
- Other allergies
- Poor blinking
- Infections
- Physical Irritation

Lids

Papillary conjunctivitis is the common problem found with contact lens users. It is an inflammation of the papillary conjunctiva(upper lid) characterized by the presence of irregular papillae.

Symptoms ;itching on lens removal, discharge in the morning ,severe lens deposit causing blurred vision, gradual deterioration of comfort .It may cause due to allergic response to the lens material. Auto immune allergic response to protein deposit, solution allergy, mechanical and environmental irritation.

Treatment

Consider medical referral for treatment usually with steroids.Other measures are
1. Discontinue lens wear for three months.
2. Fit a new lens
3. Ensure regular lens replacement.
4. Eliminate all preserved solutions.
5. Ensure regular use of enzyme tablets.

Environmental and General Factors.

Some of the problems are created not by the lens but by the external factors.Air conditioning ,low humidity , high altitude , computer use ,polluted atmosphere, poor light etc. cause discomfort.

Alcohol use ,diet ,systemic drugs, oral contraceptive, tiredness, poor health, pregnancy, mental tension etc. can increase the symptoms of discomfort .Poor blinking can cause dehydration and deposit.

BASE CURVE

The base curve of a spectacle lens and its affect on the wearing comfort of the patient is one of the most ignored and least understood principles of refractive optics.

In order to understand the concept of the base curve, it helpful to understand how a glasses lens is made. Although some labs make lenses in a mold, most lenses are ground from a lens blank. The blank has a front surface curve that is not changed in the fabrication process. The prescription is made by cutting away material from the back of the blank to form one (sphere) or two (cylinder) **"ocular" curves**.

This is called "minus cylinder form". The back surface minus curvature allows the lens to fit closer to the eye and maintain a more constant vertex distance as the eye rotates. The slightly plus or flat front curve creates a cosmetically pleasing profile and forms a edge that fits well into the frame. Lens blanks come with a range of front surface curves. Lens manufacturers apply mathematical formulas according to a "**Corrected Curve Theory**" that computes the optimum front curves and back curves for a given prescription. The idea is that there is an optimum combination that will minimize lens aberrations.

There is more than one **definition** of the base curve:

·

To the optician working in a lens fabrication lab, the base curve may be the flattest curve on the cylindrical surface of the lens. With modern lens fabrication techniques, this would be the flattest curve on the back side of the lens.

· As optics technicians on the dispensing side of the processes, it is most practical to think of the base curve as being the singular front surface curve of the glasses lens. This is the definition we will use.

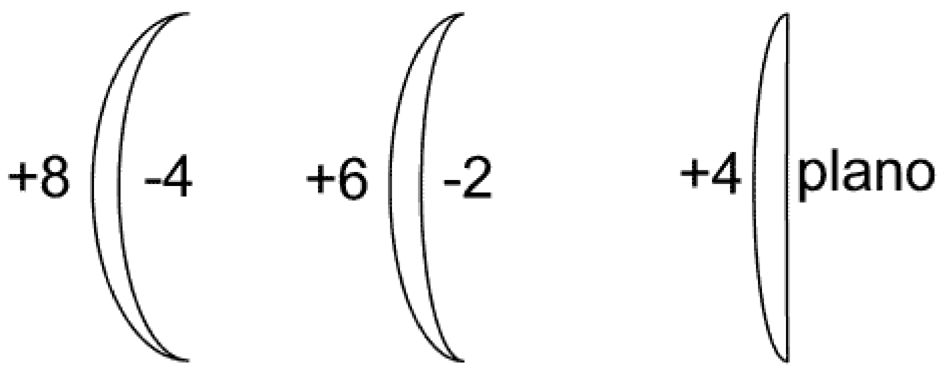
Lens blanks are generally made with base curves in two diopter increments from plano through 10 D (plano, 2, 4, 6, 8, 10). **A given prescription can be ground in several combinations of front curves (base curves) and back curves (ocular curves).**

Take for example a +4.00 D sphere:

Each of the following base curve/ocular curve combinations would yield a +4.00 D power lens. Algebraically add the front curve value and the back curve value (+8-4 = +4).

So how do you decide which combination is best? The Corrected Curve Theory tells you which combination is optimal to reduce aberrations and give the patient comfortable viewing. Generally, minus lenses will have base curves from plano (high minus) to 4 D (low minus). Plus lenses will have base curves from 6 D (low plus) to10 D (high plus).

If the Corrected Curve Theory gives the optimum curve combination for a given prescription,



why might a patient have an adjustment problem when the base curve is changed? Every glasses lens distorts the image as compared to the view of the emmetropic eye. It is the back curve (ocular curve), not the base curve, that affects the patient's view of the world. The patient gets used to this distortion and it becomes the patient's "normal" view of the world. If the back curve of a new prescription is changed significantly from the back curve of the old prescription, the patient complains of distortion. The patient might not use this terminology. The patient might simply say that the new glasses "just aren't right." To eliminate this problem, try to keep the new back curve within one diopter of the old back curve.

Realize that, depending upon the Rx change, the back curve may change even if the base curve is kept the same, and it may be necessary to change the base curve in order to keep the back curve the same. When evaluating glasses problems, remember that it is the ocular curve (back curve) that matters most. You will need to be able to read the base curve and calculate the ocular curve.

The ocular curve is found with the following formula:

Ocular Curve (OC) = Lens Power (P) - Base Curve (BC)
Values in diopters

Example: Lens power = +2 D, Base Curve = 8 D

Ocular curve = (+2) - (+8) = -6

Example: Lens power = -4.00 D, Base Curve = 4 D

Ocular curve = (-4) - (+4) = -8

Example 1:

Mrs. Kadidlehopper comes into the office wearing a +4.00 diopter lens. Her base curve measures 8 D. She has an early cataract and her prescription is changed to +2.00. Next week she comes back complaining of slanting lines when reading.

Her glasses are checked and the new prescription measures +2.00 D with an 8 D base curve. We can calculate the ocular curve of the old prescription to be -4 D (4 - 8 = -4). We measure the base curve of her new glasses lens and it is also 8 D, just like her old glasses. We calculate the ocular curve on the new lens to be -6 D (2 - 8 = -6).

So, Mrs. Kadidlehopper's base curve was kept the same, at 8 D, but we have learned that it is the ocular curve that really matters with Mrs. K's perception of the world, and that changed from -4 to -6. Could this two diopter change be causing her problem? Probably. It would be worth remaking the lens to find out.

How would we keep the ocular curve the same, at -4 D? Of course there is a formula for that too, and it is similar to the ocular curve formula:

Base Curve (BC) = Lens Power (P) - Ocular Curve (OC)

In our example, we want to keep the ocular curve at -4, but we are changing the lens power to +2. What base curve will we need to change to?

BC = (+2) - (-4) = +6 So, we will be changing the base curve from 8 to 6 in order to keep the ocular curve the same. Since the lens manufacturer may use an 8 base curve for a +2 D lens power, you would need to make a note on the Rx that you are requesting a 6 D base curve.

Example 2:

Mr. Guy Wire has had cataract surgery on his right eye. Before surgery he was a +1.00 D hyperope in each eye. After surgery he became a -1.00 D myope in his right eye. After receiving a new right lens in his glasses, he comes back into the office complaining that the glasses "don't seem right".

A re-refraction confirms his prescription, the optical centers of the lenses match his PD, and the lens was ground to the correction. A check of the old and new base curves reveals the following:

Old right lens: Rx = +1.00 BC = 6 D OC = -5, change to:
New right lens: Rx = -1.00 BC= 4 D OC = -5

At first glance it may seem that a change in the base curve may be causing his problem.

Remembering that it is the ocular curve that matters most, we calculate the ocular curve for each lens:

Ocular curve (OC) = Lens Power (P) - Base Curve (BC)

Old right lens: P = +1.00, BC = +6.00
OC = +1.00 - (+6.00) = -5.00 D

New right lens: P = -1.00, BC = +4.00
OC = -1.00 - (+4.00) = -5.00 D

So, the ocular curve in each lens is the same. It appears that someone has changed the base curve to keep the ocular curve the same, a procedure that should help the gentleman adjust to his new glasses. In this case the base curve change is probably not contributing to the patient's problem.

A more likely cause for his difficulty would be the mismatch of having a plus lens in front of one eye and a minus lens in front of the other eye. The plus lens causes a magnification of the image on the retina of the left eye, and the minus lens causes a minification of the image on the retina of the right eye, making it difficult for the brain to fuse the images.

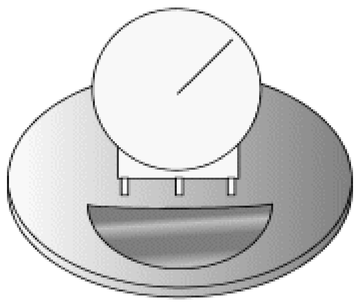
What can be done for this patient? In terms of a glasses prescription, not much more, except perhaps slab-off grinding if the patient wears a bifocal and is complaining of reading difficulty. If the patient needs cataract surgery in the left eye, then the outcome could be adjusted so that both eyes are slightly nearsighted after surgery. If that is not a option, contact lenses could be used to minimize the retinal size difference. With such a minimal

correction in each eye, this patient may do best by only wearing glasses to read.

How To Measure the Base Curve

The base curve of a glasses lens is measured with a **Geneva Lens Measure**, sometimes called a "lens clock".

The lens clock has an indicator that points to plus (black) or minus (red) diopter powers. It has three prongs that are placed on the lens surface. The center prong moves the indicator hand and is placed on the optical center of the lens. The diopter power of the



base curve is read from the dial. Since the curve on the front surface will always be either positive or flat, you will read the black numbers on the dial.

The prongs are placed in a perpendicular fashion on the front surface of the lens to measure the base curve. When reading a multifocal lens, the prongs of the lens clock are placed horizontally with the center prong placed over the optical center (just above the line on a flat-top bifocal).

The clock can be checked for calibration by placing the prongs on a flat surface. The clock should read zero in this position.

Computer Vision Syndrome

Dr. Bharathy
District Ophthalmic Surgeon, Manjeri

With so many of us using computers at work, computer eye strain has become one of the major office-related health complaints. Studies show that eye strain and other bothersome visual symptoms occur in 50 percent to 90 percent of computer workers. These problems can cause physical fatigue, decreased productivity and increased numbers of work errors.

Computer vision syndrome (CVS) is a temporary condition resulting from focusing the eyes on a computer display for protracted, uninterrupted periods of time. Some symptoms of CVS include headaches,blurred vision, neck pain, fatigue, eye strain, dry, irritated eyes, and difficulty refocusing the eyes. These symptoms can be further aggravated by improper lighting conditions (ie. bright overhead lighting or glare) or air moving past the eyes (e.g. overhead vents, direct air from a fan).

Pathophysiology

CVS is caused by decreased blinking reflex while working long hours focusing on computer screens. The normal blink rate in human eyes is 16–20 per minute. Studies have shown that the blink rate decreases to as low as 6–8 blinks/minute for persons working on the computer screen. This leads to dry eyes. Also, the near focusing effort required for such long hours puts strain on ciliary muscles of the eye. This induces symptoms of asthenopia and leads to a feeling of tiredness in the eyes after long hours of work. Some patients present with inability to properly focus on near objects after a short duration. This can be seen in people aged around 30–40 years of age, leading to a decrease in the accommodative focusing mechanisms of the eye. This can be a setting for early presbyopia.

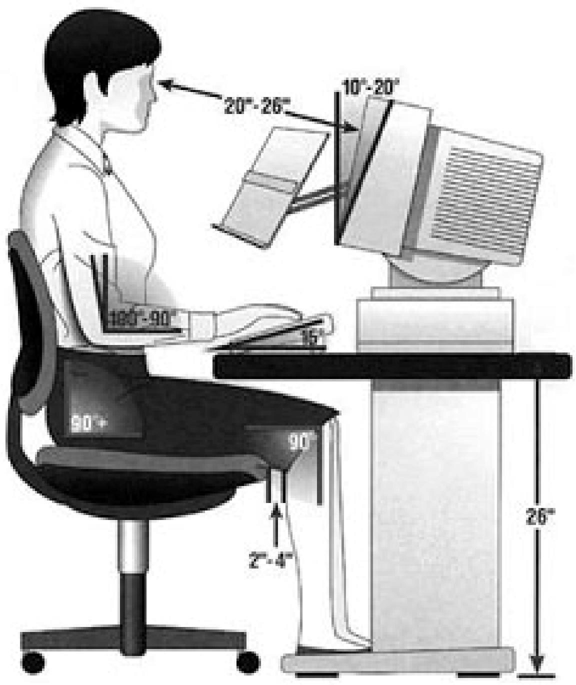
Therapy

Dry eye is a major symptom that is targeted in the therapy of CVS. The use of over-the-counter artificial-tear solutions can reduce the effects of dry eye in CVS.

Asthenopic symptoms in the eye are responsible for much of the morbidity in CVS. Proper rest to the eye and its muscles is recommended to relieve the associated eye strain. Various catch-phrases have been used to spread awareness about giving rest to the eyes while working on computers. A routinely recommended approach is to consciously blink the eyes every now and then (this helps replenish the tear film) and to look out the window to a distant object or to the sky—doing so provides rest to the ciliary muscles. One of the catch phrases is the “20-20-20 rule”: every 20 minutes, focus the eyes on an object 20 feet (6 meters) away for 20 seconds. This basically gives a convenient distance and timeframe for a person to follow the advice from the optometrist and ophthalmologist. Otherwise, the patient is advised to close his/her eyes (which has a similar effect) for 20 seconds, at least every half hour.

Decreased focusing capability is mitigated by wearing a small plus-powered (+1.00 to +1.50) over-the-counter pair of eyeglasses. Wearing these eyeglasses helps such patients regain their ability to focus on near objects. People who are engaged in other occupations—such as tailors engaged in embroidery—can experience similar symptoms and can be helped by these glasses.

Here are some steps both workers and employers can take to reduce computer eye strain and the other common symptoms of computer vision syndrome (CVS):



1. Get a computer eye exam.

This is the most important thing you can do to prevent or treat computer vision problems. According to the National Institute of Occupational Safety and Health (NIOSH), computer users should have an eye exam before they start working on a computer and once a year thereafter. Be sure to tell your eye doctor how often you use a computer at work and at home.

2. Use proper lighting.

Eye strain is often caused by excessively bright light either from outdoor sunlight coming in through a window or from harsh interior lighting. When you use a computer, your ambient lighting should be about half that found in most offices.
Eliminate exterior light by closing drapes, shades or blinds. Reduce interior lighting by using fewer light bulbs or fluorescent tubes, or use lower intensity bulbs and tubes. If possible, position your monitor so that windows are to the side of it, instead of in front or back.

3. Minimize glare.

Glare on walls and finished surfaces, as well as reflections on the computer screen can also cause computer eye strain. You may want to install an anti-glare screen on your monitor and, if possible, paint bright white walls a darker color with a matte finish.
Again, cover the windows. When outside light cannot be reduced, consider using a computer hood.
If you wear glasses, have an anti-reflective (AR) coating applied to your lenses. AR coating reduces glare by minimizing the amount of light reflecting off the front and back surfaces of your eyeglass lenses.

4. Upgrade your display.

If you have not already done so, replace your old tube-style monitor (called a cathode ray tube or CRT) with a flat-panel liquid crystal display (LCD), like those on laptop computers.
LCD screens are easier on the eyes and usually have an anti-reflective surface. Old-fashioned CRT screens can cause a noticeable “flicker” of images on the screen, a major source of computer eye strain. Even if this flicker is imperceptible, it can still contribute to eye strain and fatigue during computer work.
Complications due to flicker are even more likely if the refresh rate of the monitor is less than 75 hertz (Hz). If you must use a CRT at work, adjust the display settings to the highest possible refresh rate.

When choosing a new flat panel display, select a screen with the highest resolution possible. Resolution is related to the “dot pitch” of the display. Generally, displays with a lower dot pitch have sharper images. Choose a display with a dot pitch of .28 mm or smaller.

Finally, choose a relatively large display. For a desktop computer, select a display that has a diagonal screen size of at least 19 inches.

5. Adjust the brightness and contrast of your computer screen.

Adjust the display settings on your computer so the brightness of the screen is about the same as your work environment.

As a test, try looking at the white background of this web page. If it looks like a light source, it’s too bright. If it seems dull and gray, it may be too dark.
Also, adjust the screen settings to make sure the contrast between the screen background and the on-screen characters is high. And make sure that the text size and color are optimized for the most comfort

6. Blink more often.

Blinking is very important when working at a computer; it rewets your eyes to avoid dryness and irritation.

When working at a computer, people blink less frequently — about five times less than normally, according to studies.

Tears coating the eye evaporate more rapidly during long non-blinking phases and causedry eyes. Also, the air in many office environments is dry, which can increase the evaporation rate of your tears, placing you at greater risk for dry eye problems.

If you experience dry eye symptoms, ask your eye doctor about artificial tears for use during the day. By the way, don’t confuse lubricating drops with the drops that only “get the red out.” The latter can indeed make your eyes look better. They contain ingredients that reduce the size of the blood vessels on the surface of your eyes to “whiten” them. But they are not necessarily formulated to reduce dryness and irritation.

Try this exercise: Every 20 minutes, blink 10 times by closing your eyes as if falling asleep (very slowly). This will help rewet your eyes.

7. Exercise your eyes.

A component of computer eye strain is focusing fatigue. To reduce your risk of tiring your eyes by constantly focusing on your screen, look away from your computer every 20 minutes and gaze at a distant object outside or down the hallway. Looking far away relaxes the focusing muscles inside the eye to reduce fatigue.

Another exercise is to look far away at an object for 10-15 seconds, then gaze at something up close for 10-15 seconds. Then look back at the distant object. Do this 10 times.

This exercise reduces the risk of your eyes' focusing ability to "lock up" (a condition called accommodative spasm) after prolonged computer work.
Both of these exercises will reduce your risk of computer eye strain. Remember also to blink frequently during the exercises to reduce your risk of computer-related dry eye.

8. Take frequent breaks.

To reduce your risk for computer vision syndrome and neck, back and shoulder pain, take frequent breaks during your computer work day.

Many workers take only two 15-minute breaks from their computer throughout their work day. According to a recent study conducted by the National Institute of Occupational Safety and Health (NIOSH), discomfort and eye strain were significantly lower when computer workers took four additional five-minute "mini-breaks" throughout their work day.

And these supplementary breaks did not reduce the workers' productivity. Data entry speed was significantly faster as a result of the extra breaks, so work output was maintained even though the workers had 20 extra minutes of break time each day.

During your computer breaks, stand up, move about and stretch your arms, legs, back, neck and shoulders.

Check your local bookstore or consult your fitness club for suggestions on developing a quick sequence of exercises you can perform during your breaks and after work, to reduce tension in your arms, neck, shoulders and back.

9. Modify your workstation.

If you need to look back and forth between a printed page and your computer screen, this can cause eye strain. Place written pages on a copy stand adjacent to the monitor. Light the copy stand properly. You may want to use a desk lamp, but make sure it doesn't shine into your eyes or onto the computer screen.

Improper posture during computer work also contributes to computer vision syndrome. Adjust your workstation and chair to the correct height.
Purchase ergonomic furniture to enable you to position your computer screen 20 to 24 inches from your eyes. The center of your screen should be about 10 to 15 degrees below your eyes for comfortable positioning of your head and neck.

10. Consider computer eyewear.

For the greatest comfort at your computer, you may benefit from having a customized eyeglasses prescription for your computer work. This is especially true if you normally wearcontact lenses, which may become dry and uncomfortable during sustained computer work.

Computer glasses are also a good choice if you wear bifocals or progressive lenses, because these lenses are generally not optimal for the distance to your computer screen.

Representation Given By Kerala Governemnt Optometrists' Association to The 9th Pay Commission

To

The Secretary
9th Kerala Pay Revision Commission 2010
Room No – 308, Legislature Complex,
Vikas Bhavan P.O., Thiruvananthapruam

Sir,

Sub:- Pay Revision – Views and Suggestions

Ref:-1. G.O(MS) 81/2010/Fin dt 20.02.2010
2. Notification of the 9th Pay Revision Commission dated 25.02.2010

1. We are grateful to the 9th Pay Revision Commission for the opportunity offered to place our grievances for favour of consideration by the Commission.

2. At the onset as part of this representation the following matters are presented in answer to part II. The questionnaire of the commission and our views in relation to part I are appended as annexure I.

3. The Posts causing us anxiety due to the repeated derogation by successive Pay Commissions and refusal to effect rectification and their present scale, of pay are a s follows.
    1. Ophthalmic Assistant Grade II – Rs. 6680 – 10790
    2. Ophthalmic Assistant Grade I – Rs. 7990 – 12930
    3. Senior Grade Ophthalmic Assistant – Rs. 10790 – 18000
    4. Camp Co-ordinator – Rs. 11070 – 18450

    The following posts in Ayurveda and Medical Education Departments are also allied ours in the matter of qualification and status and therefore are due for consideration along with our cadres.
    1. Nethra Technician Ayurveda- Rs. 8390 – 13270
    2. Tutor Technician Medical Education – Rs. 10790 – 18000.
    3. Orthoptic Technician Medical Education- Rs. 10790 - 18000

4. We request that the injustice due to anomaly with effect from 01.07.2004 be looked into first and rectified before the revision of scales for our cadres is considered based on general principles.

5. Qualification and functional responsibilities are acknowledged by two of the main factors for consideration in award of pay scales. The relativity with other posts in the same department is another factor. In consideration of award of scales in 2004 all these factors where given the go-bye, by the 8th Pay Commission and they were not rectified by the Government. We therefore request that at least the 9the Pay commission go into the mater and render justice.

I. Ophthalmic Assistant Grade II

Unlike other paramedical staff with very limited jurisdiction, the Ophthalmic Assistant has to attend to work emanating from several Panchayaths. The main functions involve (1) Correctional treatment for various eye disorders. (2) School eye health check-up, (3) contact lens fixing. Not only qualifications but also onerous nature of duties, coverage of population etc. are not reflected in awarding pay scales. A copy of proceedings No EF4 – 53826/2000 DHS dated 24.01.2002 is enclosed.

A junior heath inspector has to undergo a course for ten months whereas an Ophthalmic Assistant has to undergo the course for two years after plus two. In 1997 the post of JHI was in the scale of Rs. 3500 – 5400 and that Ophthalmic Assistant was in the scale of Rs 4000-6090. In derogation of the relative status, both posts are now equalized in the scale of Rs 6680 – 10790. Relativity is give ignored and that too in relation to posts in the same department. A physiotherapist in the department with comparable duration of qualifications enjoys scale of 9590 – 16650. The injustice meted out to Ophthalmic Assistants is patent and we request sympathetic consideration and redressal at least at the hands of the 9the Pay Commission. We request that the present scale be considers at least as Rs. 7990 – 12930, before effecting further revision now.

II. Ophthalmic Assistant Grade I

Posts of Health Inspector Grade II and Ophthalmic Assistant Grade I were in the scale of Rs. 4600 – 7125 before revision in 2004. Now they are in scales Rs. 8390 – 13270 and Rs. 7990 – 12390 respectively resulting in a hostile discrimination and derogation of Ophthalmic Assistant Grade I. in fairness we request that pre revision of scale 2004 be assumed to be Rs. 9180 – 15510 corresponding to Health Inspectors Grade I before their revision in 2009.

III. Senior Grade Ophthalmic Assistant

Unlike Health Inspectors with prospects for promotion as Health Supervisor, Technical Assistant, Malaria Officer, Senior Grade Ophthalmic Assistant can aspire for promotion only to the post of camp – co.ordinator - one in a district. Therefore the scale of senior Grade Ophthalmic Assistant may at least be deemed to be Rs. 11070 – 18450 is the scale awarded in 2004 before further revision in 2009.

IV. Camp. Co.ordinator

As already indicated earlier there is only one post of a Camp. Co.ordinator in a district except Malappuram where there are two posts in two mobile eye units. A copy of orders on duties and responsibilities is enclosed. Order No. PH4/89024/92/DHS

The post of Camp Co.ordinator received derogated appreciation and a higher pay scale than of Senior Grade Ophthalmic Assistant was granted after considerable difficulties and even interference by judiciary. We request that at least a pre revised scale of Rs. 11910 – 19350 in 2004 be accepted as basics for the present further revision.

V. Tutor Technician

The post of Tutor Technician in Medical Education Department is the promotion post of Senior Grade Ophthalmic Assistant. Even though repeated representations in the previous pay revisions, the scale of pay of tutor technician was not enhanced. Considering their duties in the teaching area and institutional responsibilities this post may be brought to the cadre of Camp Co.ordinator for the purpose of award of pay with a pre revised scale of 11910 – 19350, in 2004 be accepted as basis for present further revision.

VI As the posts in our Cadre lack avenues for promotion, the denial of second higher grade allowed to personnel after eight years of service in the first promoted post may be reinstated and the ratio 2:2:1 may kindly be revised as 1:1:1 in the present scenario.

7. Though there was lack of appreciation and resultant award of low scales having little relativity to posts of similar status in the Health Service Department, the 8th Pay Commission in para 5-26-15 of their report had suggested charges of designation as follows.

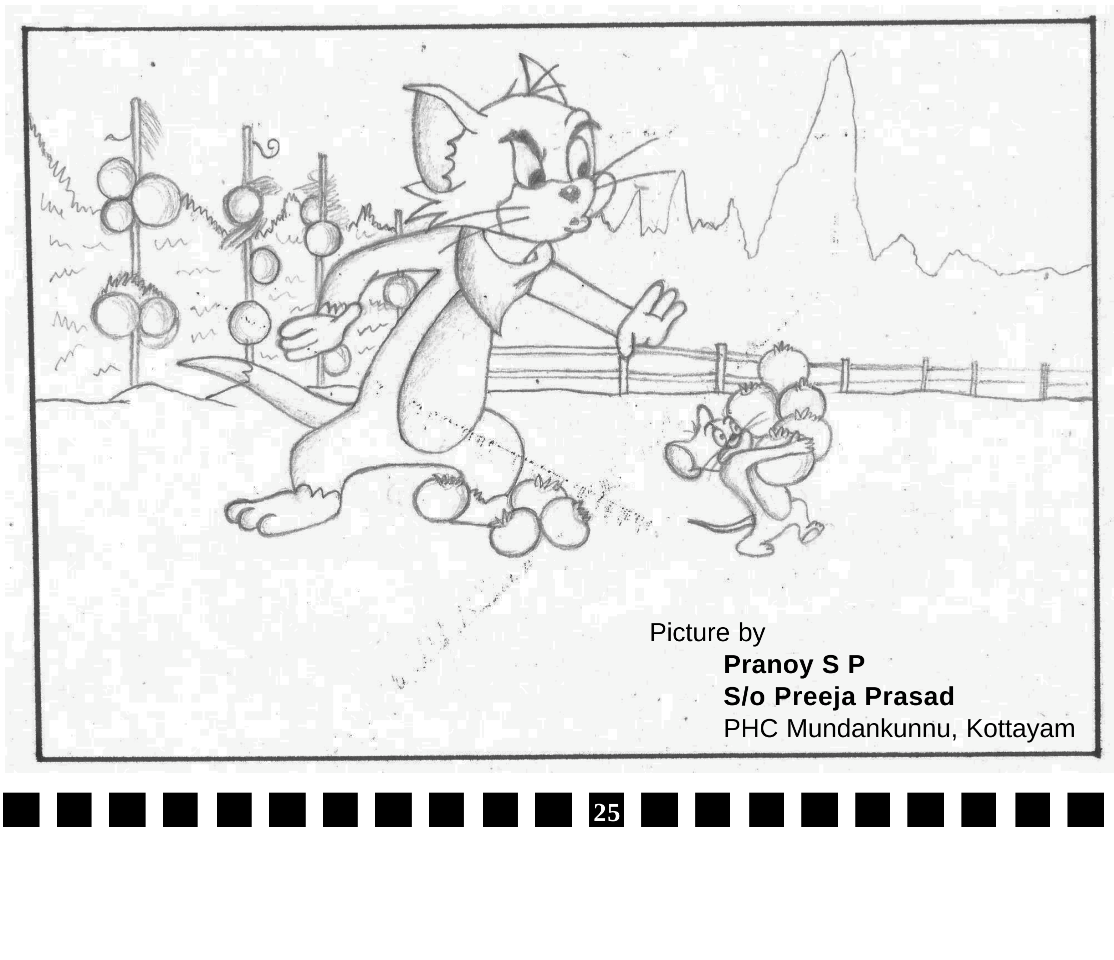
Post	*Changed designation*
Ophthalmic Assistant Grade II	Optometrist
Ophthalmic Assistant Grade I	Senior Optometrist
Senior Grade Ophthalmic Assistant	Ophthalmic Officer

The recommendations was made because of All India pattern in optometry. In other countries and middle east, similar post are allied to the term ”Optometry”. The designation Ophthalmic Assistant does not reflect the nature of duties. The posts may be re-designated as Optometrist Grade II, Optometrist Grade I and Senior Grade Optometrist to bring conformity to the duties and functions. Camp co.ordinator may be re-designated as District Optometrist.

8. At present one of the Deputy Directors of the department in the office of DHS looks after the co.ordination activities under blindness control. In some other spheres like nursing there are exclusive Assistant Directors. There has to be an officer in level of Assistant Director to co.ordinate and support the activities of our cadres for the smooth functioning of state blindness control activities and this should be allowed as promotion of our cadre. We request directions to the government as our entreaties have fallen on deaf years.

We will be grateful for an opportunity to clarify doubts if at all any.

President | Secretary



Picture by
Pranoy S P
S/o Preeja Prasad
PHC Mundankunnu, Kottayam

PROCEEDINGS OF THE DIRECTOR OF HEALTH SERVICES THIRUVANANTHAPURAM

Sub: Establishment – Health Services Department – General Transfer 2010 – Transfer & posting of Camp Coordinator –Orders issued

Order No. EF4- 3069/2010/DHS dated 7.4.2010

The following transfers and postings are ordered in respect of Camp Coordinator In General Transfer 2010

Sl.No	Name & Institution	Station to which posted
1.	Kumari Geetha.M.L District Hospital, Kanhangad, Kasargod	General Hospital, Thiruvananthapuram In the existing vacancy
2.	A.L.Amminikutty District Hospital, Palakkad	General Hospital, Pathanamthitta In the existing vacancy
3.	S.S.Babuji District Hospital, Kannur	General Hospital, Ernakulam In the existing vacancy

The date of relief and joining shall be reported promptly

Sd/-
Dr.M.K.Jeevan
Director of Health Services

To

The Incumbents

Copy to

The Accountant General, Kerala, Thiruvananthapuram
The District Medical Officer of Health
Thruvananthapuram/ Pathanamthitta/ Ernakulam/ Palakkad/ Kasargod/ Kannur
Superintendent, District Hospital / General Hospital
Thruvananthapuram/ Pathanamthitta/ Ernakulam/ Palakkad/ Kasargod/ Kannur
File, Stock File

//Forwarded//

Senior Superintendent