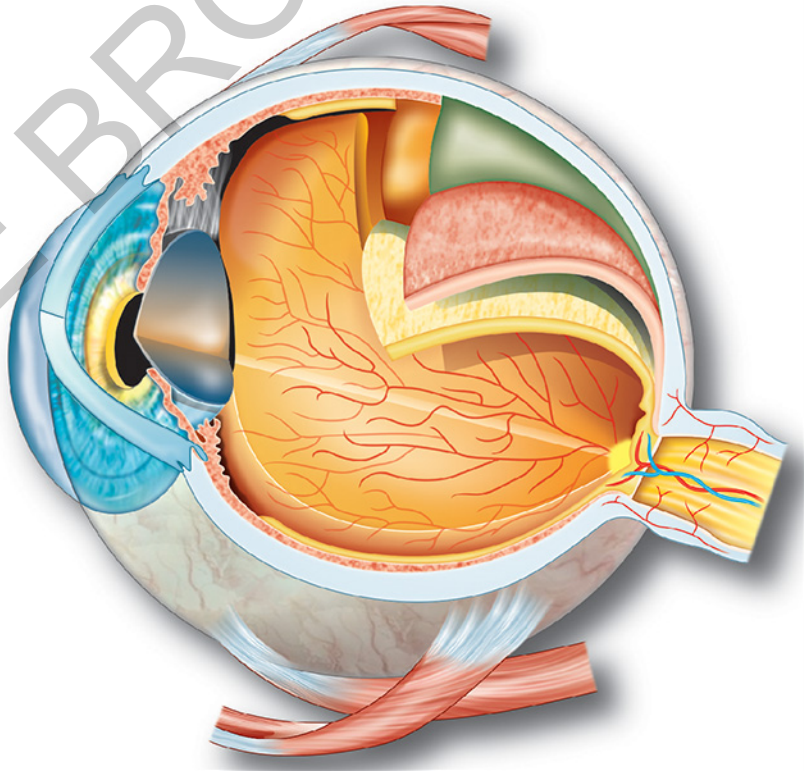
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JAYPEE

Presbyopia

Therapies and Further Prospects



Alain-Nicolas Gilg

Foreword
Hullo Alain

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CHAPTER 3

Presbyopia and Optical Compensations

Notion of optical *compensation* is particularly adequate to the field of presbyopic care. Indeed, at the moment, refractive ophthalmologist can advise his patient about compensation with:

- spectacle correction,
- precorneal contact lenses,
- or refractive surgery interventions.

Compensation is a temporary palliative treatment, to reappraise periodically and which we cannot consider as a curative treatment.

In most cases, presbyopia compensation:

- precipitates primary prevention (appearance of the affection),
- does not hamper neither secondary prevention (worsening of the affection),
- nor tertiary prevention (appearance of some presbyopic complications).

Optical compensation becomes necessary when the patient feels a marked, permanent, disabling or handicapping trouble for his professional or personal activities.

Early retired and retired themselves have considerably increased their demands standard over these last decades.

Middle-aged patients, still have plenty of activities and passions to satisfy in several occupations: strolling, running, hiking, traveling, reading, bridge playing, crosswords, sewing, doing embroidery, internet, etc. Their visual expectation covers a large field from near vision to distance.

Optical compensation experience actually depends on the individual psychological profile, and on determination of a possible pre-existing ametropia.

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Presbyopic subject has an even harder time to adapt to the need for a correction at all times as a help for intermediate or near vision, all the more since he has never had any optical compensation before (emmetropes, low hyperopes).

Use of microcomputer within middle-aged generation and beyond has revealed many micropathologies that were not troublesome until then: microstrabismi, accommodative asthenopia.

Work on microcomputer requires, when presbyopic age comes, adaptation to intermediate vision optical compensation (one arm length reading distance, what compels to take into account prolonged intermediate working distance, added to the near one (reading, knitting…) and the distant one (driving, TV, cinema…) in the majority of our patients.

In the old days, visual specificities in intermediate vision only concerned a limited number of presbyopes: musicians, draftsmen…

3.1 PRESBYOPIA AND SPECTACLES

We commonly call spectacles some ophthalmic lenses that are adapted on adequate frame.

Optical compensation is aerial when in the surrounding air. It is called we call it (sub) aquatical for a using of ophthalmic lenses in specific areas (diving mask, swimming goggles).

3.1.1 Addition Determining

Prior to any determination of near vision addition value, the subject must provide himself with the more convex compensation for distant vision: subjective monocular check, biocular balance and binocular accommodative relaxation examination.

We will appreciate relative comfort in distant vision at the end of the entire visual examination. This, in order to take the appropriate decision in the prescription.

3.1.1.1 With Maximum Accommodation Research

Once maximum accommodation determined (*See also* paragraph 1.4.3.1, Search for maximal accommodation, page 21), we divide this value by two-thirds; what gives us theoretical comfortable accommodation:

$$\text{Theorical comfortable accommodation} = \text{maximum accommodation} \times \frac{2}{3}$$

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Then we determine addition according to the working usual distance "d":

$$\text{Add} = \frac{1}{d} - \text{comfortable accommodation.}$$

3.1.1.2 With a Duochrome Test *(See also Figs 1.8 and 1.9)*

The principle of this test is coming from the eye's longitudinal chromatic aberrations (*See also* paragraph 1.4.3.2, Duochrome test, page 22), and it may then be inadequate in certain pathologies, and in certain subjects.

The patient gets his convex maximal compensation in distant vision with trial frame, equipped with addition binocularly or estimated addition according to the age.

We set Duochrome test at the patient usual working distance:

- if patient sees more contrasted in the green area: add positive spheres binocularly, until obtaining contrast equality between optotypes perception in both red and green zones,
- if patient sees more contrasted in the red area: add negative spheres binocularly, until obtaining contrast equality between optotypes perception in both red and green zones,
- if contrast equality between optotypes perception in both red and green zones, addition is correct.

3.1.1.3 With a Jackson's Cross-cylinder Test *(See also Fig. 1.11)*

This test is used with a refractor: we binocularly add a fixed cross-cylinder (FCC) to patient with convex maximal compensation in distant vision, and addition worn or estimated according to the age.

With the FCC +0.50 (–1.00) 90°, we induce a direct astigmatism superimposed on worn correction. This method can then be inadequate in high astigmatism, as well as in patients presenting with non-compensated low astigmatism.

We put the Jackson's cross at usual working distance:

- if patient sees more contrasted in the horizontals: add positive spheres binocularly, until obtaining equal contrast between perception in both horizontals and verticals,
- if patient experiences more contrasted vision in the verticals: add negative spheres binocularly, until obtaining equal contrast between perception in both horizontals and verticals,
- if equality in both verticals and horizontals contrast; the addition is correct.

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Whatever the method, test compensation with trial frame, trying to respect, as much as possible, usual working conditions (distance, light, position...).

For working distance of 40 cm, addition should not exceed +2.50 diopters (+3.00 to 33 cm). Nevertheless, if subject works at a peculiar distance, or in case of amblyopic, additions can be higher.

3.1.2 Customized Spectacles (Fig. 3.1)

The customization of glasses and frame seems essential to all professionals of vision.

Technical constraints must be able to adapt to the way of using spectacles (sports, sedentary profession, accountancy), according to the position of heads and visual strategy (stiff neck, cervical spondylosis, visionaute or cephalonaute).[3]

The lenses of presbyopic subject must allow to adapt vision in different light conditions:

- in scotopic condition: white glasses with antiglare treatments, with possibly an antistatic treatment to limit dirtying,
- glasses not exceeding the ANSI standard transmittance category 1 for vision in mesopic luminous condition,
- finally, solar tainted or polarizing glasses, with a color adapted according to the type of activity and/or visual comfort.

Frames must be curved for an efficient protection against UV-rays in photopic light.

In presbyopes, we must painstakingly determine the optical compensation:

- hyperope must have maximal convex compensation in distant vision when presbyopia arrives, if he can bear it,
- myope can possibly be under-corrected to delay the wearing of multifocal glasses, if he wants it and if he can bear such a correction.

When presbyopia comes, need for correction in distant, intermediate and near vision implies forgetting unifocal glasses to use multifocals:

- as one can expect, we determine unifocal glass, for a given visual distance, the depth of field will depend on accommodative reserve,

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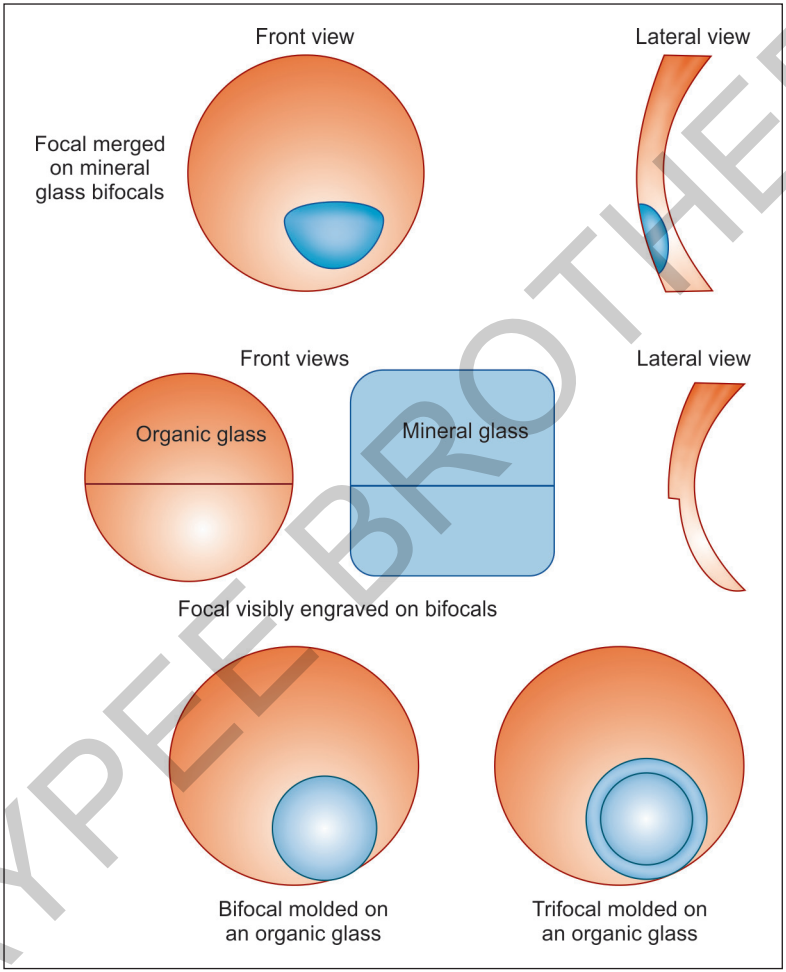


Fig. 3.1 Examples of bifocal and trifocal glasses

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- bifocal glass detains two tracks of vision: distant vision and near vision (with an additional chip); or for some particular equipment, distant vision and intermediate one (in this case, arrange for large segment dedicated to intermediate vision) or intermediate and near vision,
- the trifocal glass contains three vision tracks: distant, intermediate and near vision,
- multifocal lens, or progressive lens, shows controlled progression of additive power that we have determined with addition in near vision. Its vision zone stretches from distant to near vision, and
- semi-progressive lens, or proximity lens, shows decrease from the compensating power in near vision. Vision zone stretches from near to intermediate vision.

In office environment, proximity lens enables intermediate vision at the top of the lens, and near vision at the bottom. This spectacle has to be taken off for distant vision and especially interests the patients who prefer, for comfort or specific ametropia, not to wear any correction in distant vision.

The more presbyopia, the more the addition increases. As a result, gap rises between distant vision in the upper part of the glass and near vision in lower part.

This is why we advise presbyopic patients in their fifties not to wait too long before they try progressive glass spectacles. It indeed facilitates comfort and adaptation to them.

3.1.3 Multifocal Lenses

French optics industry has applied for many patents regarding multifocal lenses. It has imposed itself in Europe in progressive lens field, just as the Germans have.

And yet, there remains some reluctance to change unifocal glasses to get progressive ones, due to the persisting difficulty to adapt to them (up to 5% of the patients).

Signs are mostly stemming from destabilizing progression in the glass: difficulty to locate the steps of stairs (causing frequent falls in elder people), neither practical for window-watching, nor easy for handymen (hard to work on ceiling).

Prefer optician who listens to you carefully, and do not hesitate to mention both how you will use your spectacles and all specific activities you are supposed do.

When optician delivers new spectacles, he should explain the good use of the glasses and the precautions to take regarding geometry.

Nonetheless, upscale progressive lenses only satisfy the wide majority of users under few conditions:

- relevant choice for frame, the optician is there to advise you,

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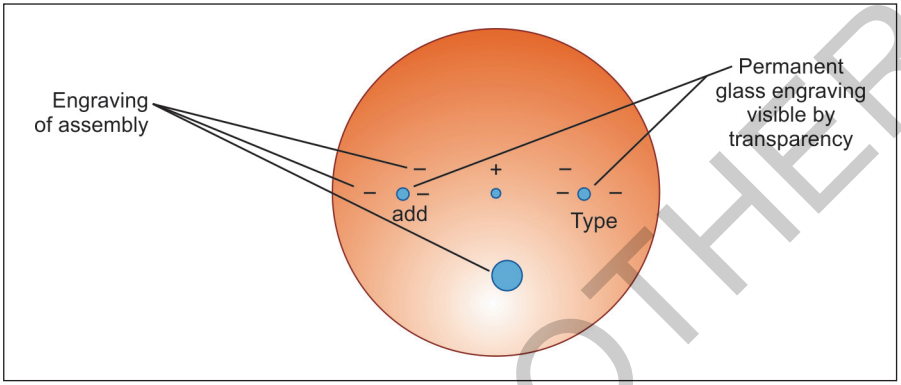


Fig. 3.2 Example of progressive glass

- glass geometry must be in adequacy with the use of the patient,
- if the patient is already wearing progressive spectacles and satisfied with it, go for the same type of geometry,
- although entry-level glasses are cheaper, they are not adapted to all presbyopes,
- we must take the measurements thoroughly. Progressive lenses (Fig. 3.2) centering is essential in presbyopes who have to be able to use different available vision tracks in the glass with minimal gesture and optimal ease,
- distant compensation must be as convex as possible (according to the patient's visual comfort) and addition must not be too high. For the great majority of presbyopes, addition is coherent regarding the age.

It is still too often that we find too high additions, leading to undercompensated hyperopias (not "positive" enough distant vision) or overcompensated myopias (too "negative" distant vision). This remains a well known cause of progressive lenses rejections:

- inappropriate correction of small cylinders. Before prescribing a cylinder of 0.25 or 0.50 diopter to a subject who has ever worn any astigmatism correction, we should make sure there is a real benefit from this correction:
  - visual acuity gain thanks to cylinder and not to spherical equivalent,

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- increased visual comfort thanks to cylinder,
- it is not about any tensional astigmatism (generally inverted or oblique).

Otherwise, distortions that the eye-lens distance induces would happen to be particularly disturbing, even more in case of progressive glass spectacles.

Besides, unless really beneficial, we would rather avoid changing power and/or cylinder axis just before first progressive lenses. Then and even afterwards, be aware to all variations of astigmatism:

- we should also test binocular vision: the quality of the fusion and stereoscopic vision. In case of abnormalities, if possible, do suitable orthoptic training before making any eyeglasses.

Binocular vision is normal if clear and simple and comfortable. Binocular vision is abnormal if double, blurred or uncomfortable (related to symptoms).

We have considered for a long time that anisometropic patients, and deprived from binocular vision, could not wear progressive or digressive glasses; this is not exactly right.

Even though these cases remain the most frequent causes for patients not adapting to progressive glass, majority of them get used to it without any problem.

The marks of dirt and other traces remaining on ophthalmic glass often annoy presbyopes a lot. We have to be convincing about the importance of choosing good quality treatments for glass surface, associated with antistatic treatment.

It is widely accepted that cleaning the glasses of spectacles again and again with detergents as stain remover or household products may alter irreversibly optical surface. Please, keep off these products from your spectacles.

To take care of glasses, we have to use specific products or a clean chamois wipes, to avoid wiping glasses with any tissue, for it could scratch them, and to alter surface treatment. So we protect treatments and synthetic glass, not expose spectacles to high heat (do not leave them in car parked in full sun, do not wear them in sauna or hammam…).

In case of intolerance to progressive glasses, your ophthalmologist will take care to check optical quality (entry, middle or high end), which some optician partners scarcely put into question, and to check the absence of all binocular vision abnormalities.

The discovery of decompensated horizontal heterophoria can lead to ad hoc orthoptic rehabilitation.

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Heterophoria or dysphoria is a convergence disparity between both eyes by oculomuscular dysfunction. Trouble is often latent, examined with cover-test. Heterophoria can be in convergence (esophoria) or in divergence (exophoria).

Just as in case of vertical heterophorias, after 4 or 5 years of re-education, recurrent decompensation in horizontals would lead to prescribe prismation included in the ophthalmic glass.

Heterophoria or phoria or dysphoria defines the position of the eyes in passive position, fusion is utterly dissociated. Phoria is said "decompensated" when the subject cannot keep fusion comfortable: binocular vision can then be blurred or split; complaints of headaches, ocular itching or burning-sensation, eyestrain excessive lacrymation…

It is more and more frequent that a convergence default, resistant to orthoptics rehabilitation, unveils a postural impairment syndrome (dysproprioception).[4]

The proprioception is the sense of body segments (*See also* paragraph 1.4.2, Ergonomics, page 20). This direction plays a part in statics (orthostatism) and dynamics (running, jumping, etc.). Proprioception clinical pathways interest several organs:

- feet, eyes,
- teguments (skin),
- internal ear, jaws,
- vestibular system, and
- musculoskeleton.

An impairment of this sense (dysproprioception) leads to involuntary and unconscious phenomenon. Compensative phenomenon sometimes induces pains, contractures or vertigos.

In clinical posturology, proprioceptive deficiency is within the range of multimodal therapeutic approach. At ophthalmoposturological level, oculomotor stimulation is based on the interposition of low power prisms, which balance the visual adaptation (active prismation).

Re-equilibration must come with a rehabilitation possibly in association with the other captors (proprioceptive soles, orthognathic splint, orthopraxis, vestibular rehabilitation) in order to make out a global postural reprogrammation.

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Decompensated ocular dysproprioception comes with a tonical contracture of trunk, neck musculature and oculomotor muscles influencing presbyopic incomfort with progressive lenses spectacles.

As long as a subject does not compensate dysproprioception, progressive spectacles may be not well tolerated.

This is, in my opinion, a frequent and curable cause of intolerance to progressive glasses that we have to take into account, instead of proposing an optical compensation with bifocal glasses, less esthetic and less functional, or even two different pairs of spectacles.

How technical optic glasses adaptation may be, even with the most recent progressive lenses, presbyopic patient can ask for an occasional contactological solution (as a complement of his spectacles) or permanent (replacing his spectacles).

3.2 PRESBYOPIA AND CONTACT LENSES

As all precorneal lenses, adaptation in contact lenses needs taking into account different factors in order to improve handling, comfort and duration of wearing.

In presbyopes asking for occasional lenses, the best choice will be to go for hydrophilic soft contact lenses: disposable, hydrogel or silicohydrogel ones.

The appearance of soft lenses on the market (until then hydrogel) with variable silicone content enabled a widening of the offer to wearers:

- prolonged wearing made possible with a permeability superior to oxygen,
- better tolerance on dry eyes because of lower hydrophilia.

Silicohydrogel soft lenses are more resistant by touch and sometimes give the impression of a certain adhesion on the eye, in spite of their high permeability to oxygen that allows a more or less prolonged wearing during night and day.

3.2.1 Soft Lenses (Fig. 3.3)

The presbyope adaptation with contact lenses must take into account patient activities (golf, nautism, aerial sports, work conditions, handling of the lenses on a responsibility post).

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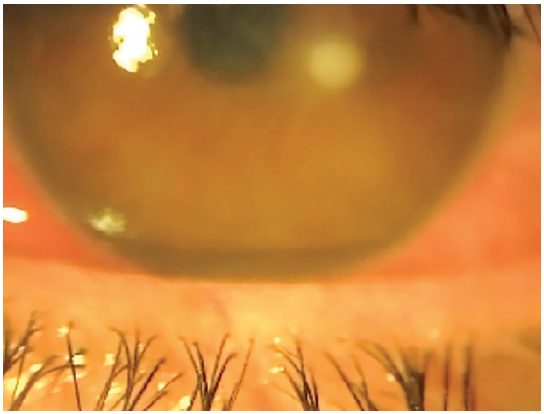


Fig. 3.3 Corneal abscess developed under contact lens (Personal picture obtained on digital RO5000 Rodenstock slit lamp)

The abscess (white disk) under precorneal contact lens is a scarce but severe contactological complication. Indeed, it can lead to eye perforation or corneal wound with visual artefacts. Like anyone wearing contact lenses, presbyope with lenses must respect recommended hygiene, handling and care rules, and should consult a doctor in case of the slightest doubt. Early and well-targeted treatment is often the most efficient.

Disposable contact lenses: one-day, one-week, 15-day, 1-month or 3-month use lenses will be to replace presbyopic spectacles.

In the presence of greasy tears soiling lenses, short-term disposable contact lenses will fit best, as opposed to asymptomatical and very tolerant people who will be up for longer term disposable contacts.

In case of initial adaptation, lenses handling can dissuade the presbyope, even more when he has not put on his first lens and when the subject is not able to see correctly without his spectacles!

Contrary to teenagers, presbyopes using lenses are far more worried about hygiene, as the low rate of infections under contact lenses in this age bracket shows it (Fig. 3.3).

Detailed information and care notebook will be part of the meticulous education of wearers.

It is always important to remind patients of hygiene rules (clean and dry hands, exclusive use of rinsing products, disposing of the lenses if any doubt, frequent deproteinization) to avoid all surface infection (abscess under lens, amibian keratitis) (Fig. 3.3).

We have to exclude all received ideas about the impossibility for presbyopes to wear lenses, especially in high ametropic, astigmats and anisometropes.

Contactological solutions do exist and we should propose them to all the presbyopes who ask for them.

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Presbyopia

Therapies and Further Prospects

Presbyopia remains inevitable, but, after all, is wearing glasses the only solution? *Presbyopia: Therapies and Further Prospects* brings the answer to this question often asked by presbyopes.

After considering the various troubles in accommodation, except in presbyopia, pharmacological substances acting with the ciliary musculature as well, Alain-Nicolas Gilg presents a comprehensive review of the visual impairment associated to the age-related debilitation.

Principles of spectacles correction in presbyopes are detailed, as well as the different contact lenses adaptation techniques.

The book not only covers the whole compensating ocular surgeries: conductive keratoplasty, LASIK monovision, presby-LASIK, phakic lenses, bipseudophakia, or multifocal intraocular lens (IOLs), but also the surgical techniques involving the accommodation: ciliary sclerotomy, scleral expansion, accommodative IOLs…

Numerous illustrations bring explanations in a few technical domains. The index directs the reader conveniently in the text by means of keywords or contextual ideas.

Necessary to vision specialists: ophthalmologists, optometrists or orthoptists, the book will be useful for general practitioners, gerontologists, nurses… and for the professionals interested in vision, offering a comprehensive and prospective synthesis in this field. The book will inform undergraduates and postgraduates in sciences and will answer the more and more demanding warned public.

Alain-Nicolas Gilg MD has collaborated for 20 years as attached Practitioner in Ophthalmology Department, Lyon's Hospital, France. He is now Medical Director, Lyon's Wilson Eye Center; and the Chief, Anterior Segment and Refractive Surgery Department in his office on a private practice basis. After his postgraduate in research on the biomaterials, Paris' Hotel-Dieu Hospital, France, he developed clinical applications in contact lenses, ophthalmoposturology, and microintraocular device for presbyopic surgery. Wilson Eye Center is also well-known as a training setting for students involved in vision careers.



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