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Subspecialization: is this the way to go?

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Subspecialization has become a global trend in many developed countries. While doctors are exposed to different branches of medicine during their undergraduate training, most are able to pursue their careers in only one specialty of interest. Within different specialties, doctors are often further directed into different subspecialties within their discipline. Whereas subspecialization can certainly improve the standard of care because specialists have more exposure in their area of interest and have more in-depth clinical and surgical skill, ‘non-specialists’ have a greater chance of treating patients with conditions outside their discipline.

With the advances in medical technology, new investigative and diagnostic equipment has been developed to assist doctors in diagnosis and management of their patients. Nowadays, not only clinicians but also investigative equipment has become subspecialty-specific. Ophthalmology, being a highly specialized and technologically demanding discipline, relies heavily on the use of sophisticated devices for investigation, diagnosis, and treatment. Ocular coherence tomography (OCT) and photodynamic therapy (PDT) have been used to diagnose and treat various posterior segment diseases while ultrasound biomicroscopy (UBM) and confocal microscopy have been widely used for evaluation of the anterior segment. Voo et al have shown that OCT is a powerful means of visualizing the retinal morphology and pathology that aid the diagnosis and management of macular diseases.¹ Blair et al demonstrated in their retrospective case series that visual acuity remained stable for an average of at least 12 months after PDT for juxtafoveal choroidal neovascularization.² Avunduk et al have used confocal

microscopy for monitoring corneal healing after LASIK and shown its relationship to refractive changes.³ Gazzard et al revealed a significant widening of the anterior chamber angle in Asian eyes after laser iridotomy using UBM.⁴

These powerful investigative tools were initially invented solely for a certain purpose but are often later proven to have much wider applications than ever imagined. Examples of cross-utilization of investigative equipment between different subspecialties are often encountered. There has been a suggested association between latanoprost and cystoid macular edema (CME).^{5,6} Diagnosis of CME relies on retinal evaluation with optical lens and fundus fluorescein angiography. Furuichi et al made use of OCT scanning to study the effect of topical latanoprost in 68 glaucomatous eyes with a normally functioning blood-ocular barrier.⁷ OCT images were taken before initiation of latanoprost therapy and after 1, 3, and 6 months of treatment. These researchers found that latanoprost did not influence the retinal thickness in the fovea while the intraocular pressure (IOP) was significantly reduced at all investigated time points compared with the time before instillation. OCT can also be used to diagnose and monitor the progress of post-trabeculectomy hypotony maculopathy.^{8,9} Oyakhire and Moroi described a patient with clinical and anatomic reversal of long-term hypotony maculopathy after surgical bleb revision.⁹ The retinal thickness decreased from 423 μm to 211 μm based on OCT scanning. Clinical application of OCT is not limited to the posterior segment of the eye. Hatou et al evaluated 2 patients with hydrogel intraocular lens (IOL) calcification with OCT.¹⁰ The calcification showed up as high reflectivity

on the anterior and posterior intraocular lens surfaces on OCT, which correlated with the opacities seen with slit-lamp biomicroscopy. The possibility of using OCT for continuous non-invasive monitoring and quantification of the corneal response to dehydration stress has been explored by Hosseini et al.¹¹ These researchers measured the central corneal thickness of rabbit cornea in vivo after topical application of a glycerin-based hypertonic agent of prolonged surface evaporation of the cornea. The observed changes in backscatter were correlated with the changes in corneal hydration. The researchers concluded that OCT might be an option to quantitatively monitor the dynamics of corneal response by detecting the changes in optical properties and morphology of the cornea.

A similar investigative machine, the nerve fiber analyzer, which is widely used in the glaucoma subspecialty, has been employed to study the retinal nerve fiber layer thickness in anisometropic and strabismic amblyopia.^{12,13} These studies reported no significant difference in the retinal nerve fiber layer thickness between the 2 eyes in patients with unilateral amblyopia.

UBM, well known for its application in angle-closure glaucoma, has a lot to offer besides its use in evaluation of the drainage angle. Hershberger et al¹⁴ and Hotta et al¹⁵ demonstrated that UBM can be an invaluable tool for detecting fibrovascular proliferation at the sclerotomy sites in vitrectomized diabetic eyes with proliferative diabetic retinopathy and may aid in planning reoperation. Kunimatsu et al also used UBM to monitor their ganciclovir implants and to assess the precise location and changes of the sclerotomy sites of the sustained-release intraocular devices.¹⁶

Investigative equipments that are known for their research value often have clinical applications as well. Grupcheva et al used confocal microscopy to localize and measure various elements in different corneal layers to differentiate various presentations of iridocorneal endothelial syndrome.¹⁷ Although iridocorneal endothelial syndrome was often considered to be a primarily endothelial disease, the investigators were able to demonstrate structural alterations throughout the entire cornea using confocal microscopy. Raivio et al also used confocal microscopy to demonstrate that trans-scleral contact diode laser cyclophotocoagulation does not impair corneal innervation.¹⁸

The above examples have clearly illustrated the usefulness of cross-utilization of 'subspecialty' investigative equipments. Cross-utilization is also seen in treatment tools. One example is PDT. PDT is well known for its use in treating patients with choroidal neovascularization. Because of its effectiveness in thrombosing new vessels, its application has been extended to the treatment of ocular diseases related to neovascularization. Fossarello et al have recently investigated the efficacy and safety of treating pterygium by PDT with verteporfin.¹⁹ Ten patients with pterygium who refused excisional surgery were treated with a 689-nm

laser delivered directly onto the pterygium after verteporfin infusion. Successful photothrombosis of pterygium vascularization was obtained immediately after treatment for all patients. Revascularization of pterygium was observed in 70% of patients after 1 month and treatment was repeated after a 3-month interval. At the end of the study, 8 of 10 patients demonstrated corneal scarring with absent or minimal vascularity. In this preliminary report, PDT with verteporfin was found to be a safe procedure to arrest the growth of pterygium and was recommended for patients with a low- or medium-grade pterygium who refuse a surgical approach.

Corneal stromal vascularization is known to reduce graft survival rates.²⁰ Thrombosis of these vessels may improve the surgical outcome. A few animal studies have demonstrated the effectiveness of PDT in causing regression of corneal new vessels.^{21,22} Fossarello et al were able to photothrombose corneal neovascularization in 2 patients using PDT without serious side effects.²³ Large-scale clinical studies are needed to prove whether or not occlusion of the corneal neovascularization with PDT improves the outcome of penetrating keratoplasty.

Neovascular glaucoma is another ocular disease for which PDT may be applicable. Parodi and Iacono have performed a prospective non-comparative case series of 4 patients with neovascular glaucoma.²⁴ PDT was performed following the parameters of the Treatment for Age-related Macular Degeneration with Photodynamic Therapy Study by directing laser at the anterior chamber angle and iris surface using a Goldmann 3-mirror contact lens. There was complete obliteration of the angle new vessels, partial occlusion of the iris neovascularization, reopening of the angle, and IOP reduction. These results demonstrated that PDT may be beneficial for neovascular glaucoma unrelated to retinal ischemia.

PDT has also been shown to be effective for modulation of wound healing in glaucoma filtration surgery.²⁵ Forty two eyes of patients with progressive glaucomatous optic disc cupping, progressive visual field impairment, and sub-optimal control of IOP despite maximum antiglaucoma therapy were recruited. A photosensitizing agent was injected subconjunctivally in the area where the trabeculectomy was to be performed 15 minutes before trabeculectomy. The area was irradiated with photoactivating blue light for 8 minutes after a limbal-based conjunctival flap had been created. Postoperatively, 25 eyes (59.5%) had an IOP decrease to a mean of 15.8 mm Hg without medication and 7 eyes (16.7%) showed good IOP reduction of <21 mm Hg with topical antiglaucoma medication(s). Clinical follow-up examinations revealed no local toxicity, uveitis, or endophthalmitis. This pilot study demonstrated the potential role of PDT in prolonging bleb survival.

Conjunctival and eyelid tumors may also benefit from PDT. Barbazetto et al treated 3 patients who had conjunctival squamous cell carcinoma with PDT.²⁶ Angiographic occlusion

of tumor vasculature was observed in all patients 1 week after treatment. Two patients had complete regression for the entire follow-up period. One large tumor involved both the conjunctiva and the cornea. Only the treated areas showed tumor regression in this case.

Rossi et al treated a 55-year-old man who had a squamous cell carcinoma in the middle third of the lower eyelid with PDT after application of topical 5-aminolevulinic acid.²⁷ The tumor regressed with rapid healing. There was no recurrence after 6 months of follow-up. The above examples illustrate that ophthalmic equipments and interventional treatment

should not be viewed as subspecialty-specific. With the innovation of clinicians, investigative equipments and treatment modalities can be fully utilized across different subspecialties. Although they are often viewed as subspecialty specific, limiting the access to such devices will only hinder the advancing pace of modern medicine. Both trainers and trainees should keep an open mind and encourage cross-utilization of these equipments and treatment modalities. With more flexibility and easy access to these powerful tools, new research ideas and breakthroughs will follow, which will definitely lead to improvement in the quality and standard of medical care.

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