

Self-Refractation and Self-Adjustable Spectacles

Preface

The Centre for Vision in the Developing World (CVDW) recognises that uncorrected refractive error is a major problem and supports the aims of the global community in tackling it. CVDW recognises the efforts that the WHO and other bodies are making in their drive to provide effective, sustainable solutions to this problem around the world.

However, these efforts should be seen in the unfortunate reality of current and likely future provision of eye care in many developing world nations: quite simply, the number and distribution of trained eye care professionals in these countries is far too small meet the needs of their people. Despite efforts to the contrary, hundreds of millions of people around the world who require only a simple pair of eyeglasses yet do not receive even this modest provision of eye care. If we are forced to use only the conventional model of spectacles dispensing and distribution, this unfortunate situation will not change in the foreseeable future without unprecedented, and unlikely, transfers of resources from rich to poor (one estimate for refractive error on its own is \$26bn per year, or \$120 per person¹ assuming a pair of spectacles lasts the desired three years).

CVDW believes that two mutually-related approaches, self-refraction and the deployment of self-adjustable spectacles, can help in meeting this simple need using relatively few resources.

Among its aims, CVDW:

1. Supports research into the efficacy of self-refraction in all populations and suitable age groups;
2. Supports research into the effective deployment of appropriate vision correction methods, including and not exclusively self-adjustable spectacles, in areas of the world that need refractive eye care.

This statement is intended to set out CVDW's position with respect to self-refraction and self-adjustable spectacles.

Definitions

Self-refraction

A method where a subject seeks to achieve best-corrected vision using an appropriate protocol under trained supervision and suitable apparatus under his or her own control.

¹ Smith, TST; Frick, KD; Holden, BA; Fricke, TR; Naidoo, KS, 2009, Potential lost productivity resulting from the global burden of uncorrected refractive error, Bulletin of the World Health Organisation, 87

Self-adjustable spectacles Spectacles with a variable spherical power whose design allows for sphere power adjustment by the user whilst wearing the spectacles, typically as part of a self-refraction procedure.

Two different concepts

Self-refraction and self-adjustable spectacles are two distinct but related things. As such it is important to consider them to be separate tools with their own aspects.

Self-refraction promises two main benefits:

1. A relatively quick method of determining refractive error that reduces the training requirements for personnel conducting refractions. This lowers one of the main barriers to deploying refractive eye care across many developing countries;
2. The freeing up of clinical time to concentrate other areas.

Self-adjustable spectacles offer:

1. A tool for use with self-refraction;
2. A ready-made pair of spectacles that can be dispensed immediately after refraction (whether by self-refraction or conventional methods such as subjective refraction);
3. Elimination of the delays and extra expense incurred when refractions and dispensing are conducted at separate locations;
4. A very significant reduction in the logistical challenges and costs involved in supplying the many possible different powers of prescription lenses.

The research and application of self-refraction

Self-refraction, using self-adjustable spectacles, has been compared with conventional refraction methods in adults in a number^{2,3} of published trials. Research⁴ has also been conducted on the ability of teenage children to self-refract. CVDW believes that the outcomes of the existing research justify field trials of suitable self-adjustable spectacles.

Self-refraction has been used successfully around the world in a number of supervised deployments where tens of thousands of self-adjustable spectacles and reading spectacles have been distributed to adults. Other deployments are planned for the near future as part of government-approved national programmes⁵.

² Douali, MG; Silver, JD, 2004, Self-optimised vision correction with adaptive spectacle lenses in developing countries, *Ophthalmic Visual Optics*, 24

³ Smith, K; Weissberg, E; Trivison, TG, 2010, Alternative methods of refraction: a comparison of three techniques, *Optometry and Vision Science*, 87:3

⁴ He, M; Congdon, N; MacKenzie, G; Zeng, Y; Silver, JD; Ellwein, L, 2010, The child self-refraction study: Results from urban Chinese children in Guangzhou, *Ophthalmology*, in press

⁵ Vision for a Nation, Rwanda

CVDW does not condone or advocate the use of self-refraction methods in adults without appropriate oversight, or in children below the age of 13, at the present time.

The future of self-adjustable spectacles

Self-adjustable spectacles are still in their infancy compared with conventional spectacles. Aside from their very obvious potential benefits as a tool in the effort to tackle uncorrected refractive error there may be for some people a number of questions to be answered about them:

- Cost
 - A legitimate concern for those running vision correction initiatives is the cost of self-adjustable spectacles in comparison with the relative proportion of programme funding available for spectacles. Appropriate design approaches and manufacturing methods can reduce the prices of such devices towards the headline price of inexpensive off-the-shelf reading spectacles.
 - Self-adjustable glasses offer indirect savings compared with conventional spectacles: they neither require dispensing facilities nor incur the delivery, travel or lost working time costs involved in getting a prescription for spectacles turned into a pair of spectacles in a patient's hands. Their deployment requires minimal training in comparison with that needed for a conventionally-trained eye care professional. These indirect costs may not be counted in the headline cost of a pair of spectacles but can be significant (see Smith et al¹ for one estimate).
- Aesthetic appeal or comesis
 - Current self-adjustable spectacles designs are not generally recognised for their aesthetic beauty or styling despite efforts in nearly all cases to make the design as pleasing as possible. Their aesthetic design suffers from compromises caused by the infancy of the technologies used. This will be overcome as the technology matures.
- Durability and standards
 - There is understandable concern about the robustness of designs which may feature fluids or apparently intricate adjustment devices. However, there are similar concerns about the durability of more conventional spectacles in harsh environments and extreme conditions. The solution in both situations involves appropriate design and evaluation of proposed devices.
 - There is no reason why self-adjustable spectacles cannot be compatible with international manufacturing or safety standards.
- Fixed interpupillary distance (IPD)
 - The human visual system has a good tolerance to mismatches in IPD (i.e. an IPD that does not exactly match that of a given patient) at moderate refractive powers. The precedents in this area are off-the-shelf reading spectacles and the deployment of ready-made spectacles (but not recycled spectacles) which may be supplied in standard frames. IPD differences are therefore likely to be only a minor concern in most cases.

- Neglect of other medical conditions
 - Patients should have appropriate referral and follow up as part of any refractive error programme unless there is no possibility of this. Self-adjustable eyeglasses should be used in a way that is compatible with this aim. Indeed CVDW proposes that initiatives that include self-adjustable spectacles can help educate populations about eye care services and free up limited medical human resources for other conditions.
- Unsuitability for inclusion in refractive error programmes
 - CVDW recognises that refractive error programmes should be designed to meet the needs of a particular situation or area and not around the requirements of a given device or procedure. Consequently CVDW proposes that devices such as self-adjustable eyeglasses can be designed to meet the needs of the programmes or initiatives in which they are to be deployed. Any design team would naturally seek to meet any relevant requirements such as cost and method of deployment. The aim would be one or more devices whose use and deployment is flexible enough for programme managers to fit such devices easily into their deployments. This could potentially be done in conjunction with a self-refraction element.
 - Self-adjustable eyeglasses offer a way to help bridge the gap between current levels of provision and more complete eye care services, seed demand for prescription eyewear and, in time, help to sustain these traditional eye care approaches.

CVDW believes that concerns about cost, durability and aesthetics as well as clinical and organisational concerns can be addressed by careful design, engineering and development of deployment and distribution methods. There are no known fundamental technical or organisational obstacles to the inclusion of self-adjustable spectacles in refractive error programmes.