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REPORT OF RESEARCH VISIT

Vision correction in the remote North of Ghana using the self-refraction *Adspec*™

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Ghana, previously known as the Gold Coast, lies on the bulge of Africa north of the equator, west of the Gulf of Guinea and boasts a population of approximately 20 million. Côte d'Ivoire (Ivory Coast) is the neighboring country to the west, Burkina Faso (Upper Volta) to the north and Togo, the neighboring country to the east (Figure 1).The capital, Accra, is a coastal city that lies in the south on to the Gulf.

This article describes the deployment of self-refracting spectacles, the *Adspec*™ in Ghana. It begins with a brief overview of the eye-care system in the country. It is estimated that approximately 200 000 people in Ghana are blind from all causes[1]. This is approximately 1% compared to 0.2% in developed countries. Cataracts are the leading cause of avoidable blindness (45-50%) followed by glaucoma (15-20%), trachoma (5%), onchocerciasis, known as River blindness (5%), childhood blindness (5-10%), refractive error and low vision (5%) and others (10-15%) which are in many cases, preventable.

The National Eye Health Programme (NEHP) of Ghana aims at reducing the prevalence of avoidable blindness in Ghana through the strengthening of national, regional and district capacities that ensure affordable and available eye health. The overall aim of the NEHP is taken from the global initiative "Vision 2020 The Right to Sight" whose target is to eliminate avoidable blindness by the year 2020.

There are currently 47 ophthalmologists in Ghana of which 50% are based in various health

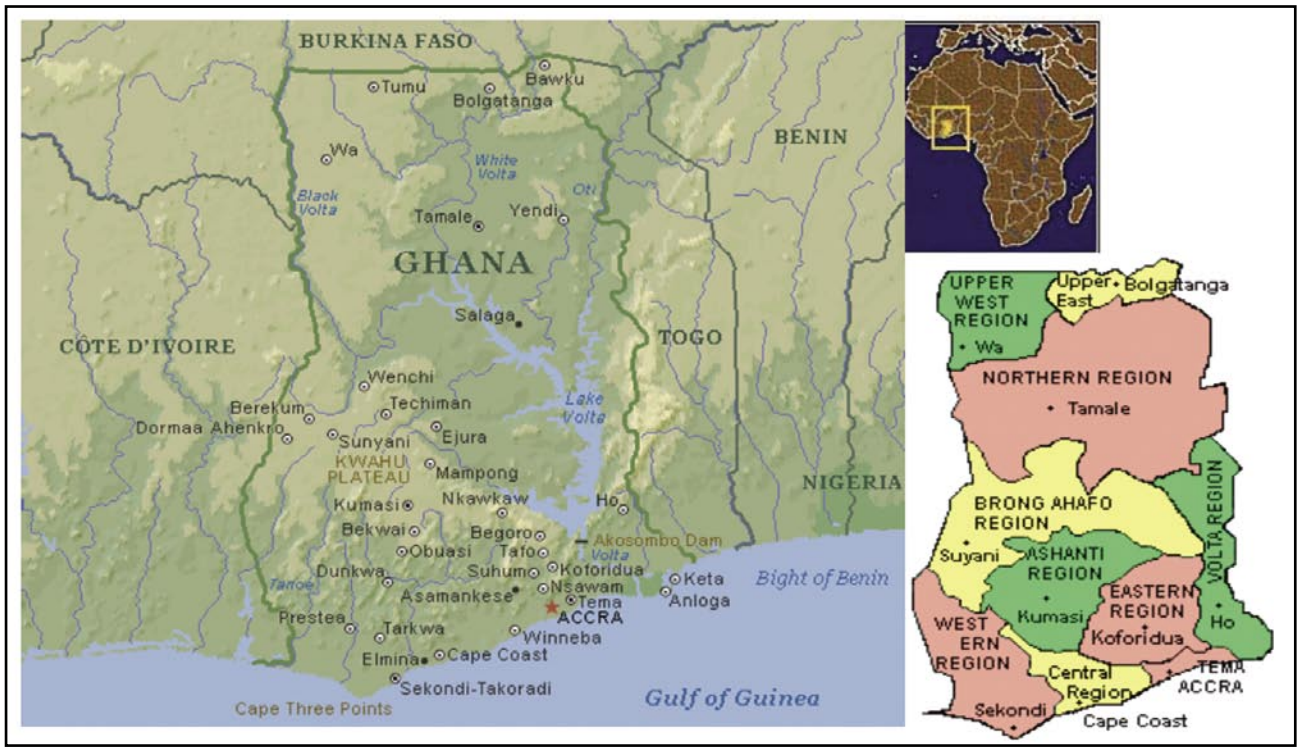

Figure 1. A geographical map of Ghana showing its location in Africa and its regions.

centres in the capital[1].Only 40 of them perform cataract surgery on a regular basis. The total number of optometrists in Ghana[1] is 40. There are over 250 ophthalmic nurses and the NEHP are considering giving them further training as refractionists to overcome the shortage of eyecare in the country.

According to the World Bank literacy in Ghana is approximately 54%. The Ghana National Functional Literacy Programme, run by the Non-Formal Education Division (NFED) of the Ministry of Education and Sport, the largest adult literacy programme in Africa, is working on this problem. Approximately 400 000 learners are currently on the programme nationwide. These learners have no formal education and many of them work as farm labourers or work in roadside stalls during the day and attend class in the evenings. The minimum age that qualifies for the programme is 18 years. Many of the learners are 60 years and older. Non-formal education teaches the learners to read, write, and compute in their local language. Vocational and cultural skills are also taught to equip them with developmental skills. The main aim is to equip them with development skills to generate their own source of income. They are then taught English to prepare them for formal education which is normal schooling.

Ghana is divided into ten Regions with approximately 130 Districts. Within these districts there are a number of zones. In NFED, there are a number of District Coordinators per Region who control and administer the non-formal education in their respective regions. These coordinators are assisted by a number of supervisors who work directly under them. The supervisors, however, have a number of facilitators who are qualified teachers, who work directly under them and they teach the learners. Each class has between 20 and 30 learners. The facilitators are voluntary workers who receive no financial remuneration for their work, however, do receive a range of material incentives (bicycles etc) from NFED on a regular basis. There are approximately 16 000 facilitators in Ghana at present.

Figure 2. The Adspec™. The top Figure shows the Adspec with the pumps on and ready for adjustment. The bottom Figure shows the Adspec with the pumps removed and ready for wear. (Reproduced with permission from Adaptive Eyecare Ltd)

Over the years many learners have been dropping out of the course. After some research, it was realized that many of the learners, besides having domestic and other problems, were having problems with their vision. Many of them live in mud houses in villages where there is no electricity, and study under lanterns and candles. To add to the problem, many of them are presbyopic and cannot see clearly at near. Eye-care is not easily accessible in the rural areas and to make matters worse, finances are also a problem. This was how I became involved with the *Adspec*™, through a British company Adaptive Eyecare Limited (AEL) that is based in Oxford, England. My involvement with them began in 2000 where field trials with the Adspecs were done in Ghana and other developing countries.

Professor Joshua Silver, an atomic physicist

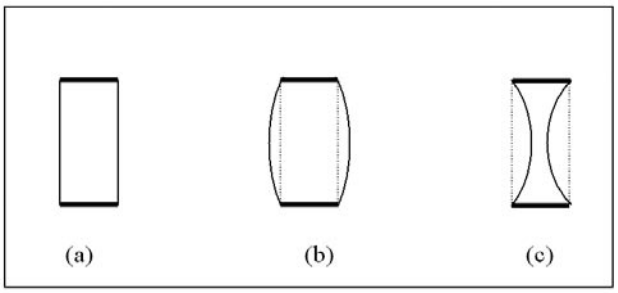

Figure 3. Profile of the Adspec. (a) Plano (b) Convex and (c) Concave. (Reproduced with permission from *S Afr Optom* 2005 **64**)

from the University of Oxford and the inventor of self- refracting *Adspec*™ had been conducting research in Ghana as far back as 1996. The research was financed by the Department for International Development (DFID), which manages the British Government's development aid programme including research in developing countries. The purpose of the Adspec (Figure 2) is to provide functional vision at a low cost, under supervision from a trained assistant, to first and third world countries throughout the world where eye care and eyewear is not easily accessible. Subjects are instructed under supervision to adjust the powers of the Adspec as accurately as possible to correct their vision and obtain the best visual acuity possible. Once the best visual acuity is obtained, the tubes are then sealed by tightening the screws on the front of the frame and cut off, the syringes are removed, and the spectacles are dispensed immediately, thus no waiting period is required.

The spectacle frame, of which the lens shape is circular, is made from a cellulose acetate material. Inside the plastic eye wire, which is approximately 8 mm in thickness, is a circular

Figure 4. Professor Silver performing an Adspecs procedure on the head of Special Education, Agnes Addo – Mensah.

Figure 5. A typical classroom in Central Accra Region where learners attend evening classes.

lens ring, 42 mm in diameter which holds two sealed expandable transparent membranes under tension. The volume between them is filled with a liquid of refractive index 1.579 by means of syringe pumps that are attached to each temple of the frame. This is illustrated in Figure 2. In its flat form the power of the lens is Plano (Figure 3a). As more liquid is injected into the chamber, the membranes expand becoming convex in shape producing a lens of positive power (Figure 3b). When the liquid is removed from its Plano form, it becomes concave in shape producing a lens of negative power (Figure 3c). The spectacle design is referred to as the *Adspec*™. The advantage of the Adspec is that the wearers can adjust the powers of the lenses to suit their visual needs. The power ranges from 6 to – 6 D. The method does not correct for astigmatism.

Quality and durability tests have been done in Oxford on the Adspec to ensure that good quality optics is provided. For example, interferometry tests done on the expandable membranes showed that the film thickness varied by less than approximately 4 *um* across its surface and this produced a wavefront error of less than approximately 40% compared to the error produced by a human eye[2]. Research has shown that if the correct procedures are followed, the majority of people can correct their own refractive error adequately and obtain good vision[2, 3]

The deployment of the Adspec in Ghana began with a first visit in August 2005. Two hundred and fourty three adult learners from the Accra area and Ada (a coastal town about 70 km east of Accra), were fitted with Adspec. Subjective

refractions were performed on all learners by two optometrists from Ghana and me. The purposes of the exercise were to see if the Adspecs would work in the field, to identify any problems that may have occurred during the dispensing and to test its function and durability. Professor Silver was also present to assist where necessary (see Figure 4). Figure 5 shows a typical classroom in Central Accra Region where learners attend evening classes.

Figure 6. Dignitaries at the official opening of the Train the Trainer course. From left to right Donald Taylor (DFID for Ghana), Chris Brealey (Second Secretary at The British High Commission, Accra), Menna Rawlings (Deputy British High Commissioner for Ghana), Samuel S Mogre (Director of NFED), Michael Wills (Marketing Director for Adaptive Eyecare Ltd), Professor Joshua Silver (Director of Adaptive Eyecare Ltd) and Agnes Addo-Mensah (Head of Special Education) for NFED.

Figure 7. Coordinators attending the Train the Trainers course at The Royal Ravico Hotel in Accra.

Figure 8. The observers with the Chief Director of NFED. From left to right Lawrence Jenkin, Agnes Addo-Mensah, Samuel S Mogre (Director NFED) and me. In front is Gilberto Adami.

A second visit in mid-October 2005 consisted of an official training course, called Training the Trainer. About 50 NFED senior staff from all over Ghana attended to learn how to use the Adspec so that they can teach the facilitators and they in turn can then teach learners with vision problems the Adspec procedure. The training was held in the conference centre of The Royal Ravico Hotel, Nungua in Accra. I conducted the training with the assistance of Lawrence Jenkin, an optical dispenser, who is the technical advisor and original manufacturer of the Adspec and two local optometrists. The training session was officially opened by the Deputy British High Commissioner for Ghana, Menna Rawlings. Other dignitaries who attended the opening were Chris Brealey, Second Secretary at the British High Commission Accra, Samuel S Mogre, Director of NFED, Agnes Addo-Mensah, Assistant Director (Head of Special Education Unit) NFED, Professor Joshua Silver, Michael Wills and Lawrence Jenkin from Adaptive Eyecare Ltd and Dr Donald Taylor from DFID for Ghana (see Figures 6 and 7).The Adspec received tremendous media coverage on national television, in local newspapers and on the national radio stations. The training appeared to be successful.

A short, but thorough, course on basic optics was taught. Information on lighting conditions on when to perform the Adspec procedure, basic anatomy of the eye and a detailed procedure of how to use the Adspec was given. The duration of the course was four days where the coordinators practiced refracting each other and also on learners from the surrounding areas who formed part of the practicals. A record form with the learners' personal details and case history, where possible, was recorded. Approximately 100 Adspecs were dispensed successfully under our supervision. Uncompensated distance and near visual acuities were measured and recorded and Adspecs were prescribed where significant improvements in visual acuities were obtained. The

coordinators were taught to recognize basic eye problems, such as red-eye, which were to be referred out to the closest surrounding clinic for treatment. Any learners with conditions that the coordinators had any doubts about were also to be referred.

The first step after the official training was for the coordinators to practice using the Adspec for a month and for us to return to Ghana again in late November for a one day refresher course. The refresher course was held in Tamale, the capital of the Northern Region which is about 600 km north of Accra, almost nine hours by motor-vehicle.

The following day all of the coordinators went out into the rural areas to refract and to dispense the Adspec to learners in the Northern, Upper East and Upper West Regions of Ghana where eye-care is absolutely minimal. The coordinators were divided into eight groups of five each and then sent out to the relevant sites in the above-mentioned regions. An initial 10 000 Adspecs were distributed to these regions. The job for Lawrence, Gilberto Adami, a new member of the team, Agnes and me (see Figure 8) was to observe how the coordinators were performing at the different sites during our one week stay in Ghana. This was a trial session for the coordinators to see if they were capable of dispensing the Adspecs and, moreover, capable of teaching the facilitators. Only once they become proficient in the Adspec fitting procedure would they be able to pass on these skills to them.

We only managed to observe four of the eight groups because of limited time. The first group we visited was in Salaga, a small town in the Northern Region approximately 100 km south of Tamale. Only after consulting with the chief in the local village were they allowed to fit the learners. The second group we visited was in Bongo, a town 15 km east of Bolgatango (the capital of the Upper East Region) which is 160 km north of Tamale and 30 km south of the Burkina Faso border). The third site visited was a village called Zebilla in the Bawku West area in the Upper East Region, approximately 60 km east of Bolgatango. The fourth site visited was in a village called Songa which is about 40 km south of Bawku, that is about 80 km north-east of Bolgatanga on the Togo border. We did not manage to visit any groups in the Upper West Region.

Figure 9. Coordinators measuring Adspec refractions outdoors.

Figure 10. A typical classroom in the rural village where formal school is held during the day and non-formal in the evenings.

Figure 11. A satisfied learner wearing his Adspec.

We were not there to see all the refractions performed or Adspecs dispensed at all the different locations. Some of the refractions were performed outdoors and some indoors. Figure 9 shows coordinators performing Adspec refractions outdoors and Figure 10 shows a typical classroom in the rural village where formal school is held during the day and non-formal in the evenings.

The syringes on the Adspecs are marked

with measurements ranging from 6 to −6 D. The measurements are accurate to about 0.25 D. The coordinators were asked to record the measurements on the syringes after the self- refractions were performed before sealing the tubes and removing the syringes. We compared the uncompensated visual acuities to compensated Adspecs acuities and the powers recorded on the syringes. This then gave us a good indication of how the coordinators were performing.

Many learners in the villages look older than their ages recorded on the record forms. This reflects the hard lives they have lived. Also many of them are illiterate and do not know when they were born. Communication is another problem because different areas have different dialects. Many of the coordinators are from different regions and they cannot understand the other languages. Asking the learners to adjust the powers of the Adspec was quite an experience for them and sometimes they did not quite know what was expected of them. Even with the help of interpreters, the language problems made it more difficult to perform successful refractions.

After arriving at each site we reviewed the record forms. A group discussion was held at the end of the day and comments and constructive criticism was offered where necessary. Considering the amount of time and experience the coordinators had with the Adspec, many of them performed very well as we were very surprised to see how quickly many of them adapted to the technique. Obviously, there were some that battled and need more time and experience. The majority of learners needed near vision correction. With each Adspec prescribed someone's vision improved significantly. Figure 11 shows a satisfied learner wearing his Adspec.

The prescriptions given may not have been perfect, or perfectly balanced between the two eyes, but, under the circumstances significant improvements in vision were accomplished which is what we set out to do. Overall, we were happy with the progress made by the coordinators considering the time they had in which to practice.

Many more Adspecs are expected to be dispensed in the other regions of Ghana during 2006 and follow-ups will be done during this time also.

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