Simerdip Kaur takes a look at the latest ophthalmology-related stories in the news.

Headline:
Glaucoma patients can monitor and treat their own IOP!

It is well known that poorly controlled intraocular pressure (IOP) is a leading risk factor for glaucoma progression, and that fluctuations in IOP may also contribute to this. Additionally, a proportion of patients with seemingly well-controlled IOP at their clinic appointment are found to have worsening glaucoma. Current practice includes the option to phase a patient's IOP to obtain a more accurate idea of the variation during a normal working day. Even so, this approach is insufficient, as studies have shown that peak IOPs often occur outside standard working hours and patients are not routinely admitted for 24 hour monitoring [1]. In 1967, Collins suggested the use of a permanent implantable intraocular sensor, and, in 1974, Greene and Gilman proposed the use of contact lenses for continuous IOP monitoring – today both devices exist [1,2].

The Triggerfish® contact lens sensor (CLS) by Sensimed has received FDA approval for marketing and use in the US. It is a single use silicone soft contact lens wearable for up to 24 hours [3]. The contact lens is embedded with two strain gauges to detect changes in radius of curvature of cornea and this information is transmitted to a wireless antenna attached to the orbit of a patient through a microprocessor. Onward signals from the antenna are then transferred to a portable recorder worn by the patient. This data can be subsequently analysed on a computer by the clinician [4]. Essentially, it measures the dimensional changes at the corneo-scleral junction area in electrical units of millivolts and thus is an indirect measure of IOP as the conversion of millivolt equivalents to milimeters of mercury is complex [1]. The CLS device costs £424-£549 for each clinical use, plus approximately £5923 for its hardware and software. It demonstrates good tolerability despite causing mild blurred vision and conjunctival hyperaemia without any serious adverse events [5].

The second device on the market is the EYEMATE® by Implandata Ophthalmic Products. It has gained CE approval and has been commercially launched in Germany, Austria and Switzerland [6]. It is a ring-shaped intraocular implant that is compatible with ciliary sulcus placement during anterior segment surgery such as phacoemulsification. The device is a wireless intraocular transducer (WIT), smaller than a 1p coin, made up of eight pressure and temperature sensors, each composed of two parallel plates [1]. The distance between these plates varies with the IOP and thus generates an analogue signal that is translated to a digital encoder and transmitted via radiofrequency waves to a handheld reader. The reader unit is placed within 5cm of the WIT to obtain and subsequently display the IOP value. The ease of recording these measurements allows for patient directed home monitoring [1].

The ARGOS study proved that the device was safe, besides causing sterile anterior segment inflammation that was amenable to treatment [7]. It provided accurate results comparable to Goldmann Applanation Tonometry readings in clinic in six patients with primary open angle glaucoma (POAG) following combined cataract surgery. However, the device did result in pupillary distortion and pigment dispersion and so it has been modified to a smaller more flexible design and is currently being studied in the ARGOS 2 study [8].

There are also two exciting new developments in the treatment of glaucoma. Professor Irazoqui and his colleagues are currently researching the use of eyeglasses to treat ocular hypertension and POAG. These glasses contain a coil that generates an electromagnetic field, which produces a current made to flow through ciliary muscles and thus reduces IOP by encouraging aqueous outflow [9]. Their preliminary results have shown a reduction in IOP of 3-6mmHg within 10 to 15 minutes in humans. A multicentre clinical trial on 30 human participants is underway to assess the duration of the IOP lowering effect and its tolerability [9].

Similarly, the Equinox Balance Goggles – the brainchild of John Berdahl as part of the National Space Biomedical Research Institute (NSBRI) – also aims to provide a non-pharmacological method of lowering IOP [10]. Berdahl's theory is centred on the notion that glaucoma is a two-pressure disease, i.e. a balance between IOP and intracranial pressure. The goggles aim to normalise the pressure differential between the two by adding negative pressure of -15 +/- 3mmHg around the orbit of the right eye for 30 minutes at a time. The investigators will be assessing the effects on axonal transport of the optic nerve and physiology of the retina. The study will be conducted on 50 normal human eyes to assess its safety and efficacy initially [10].

These developments in IOP treatment options are exciting but a few questions remain to be answered. Would patients prefer to wear glasses or goggles and alter their appearance or opt for pharmacological intervention? What if they have an existing refractive error? And what would happen to their IOP monitoring and treatment when they are not wearing these devices? Furthermore, the cost-effectiveness of these novel devices remains unknown. The clinical studies on continuous IOP monitoring have only been conducted in small groups of patients over short periods. There is limited evidence on the impact of continuous IOP data resulting in a change in management of the patient's disease and on their overall glaucoma prognosis. Nevertheless, acquiring data on continuous IOP is a step towards understanding and better managing glaucoma. In the future we may be able to offer our patients a device that not only monitors but also treats their IOP at the same time.

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