Simerdip Kaur takes a look at the latest ophthalmology-related news stories and asks which are scientific reality and which are 'fake news'.

Headline: *"Robot performs cataract surgery on patient!"*

Twenty-five years ago when *Eye News* launched, a news headline such as this might have raised an eyebrow or two, but given that there has been a slow and steady rise in the use of robotic systems in surgery over the last two decades, this is not entirely far fetched. A robot is an automated machine that is able to carry out specific and complex tasks that it has been programmed for. The origin of the word comes from the Slavonic word 'rabota', which means to serve [1].

The da Vinci Surgical System is one of the most well known robotic devices in the healthcare field and costs over US $1 million. It was approved by the Food and Drug Administration (FDA) in 2000 and has since altered the landscape for minimally invasive surgery all over the world, primarily concerning laparoscopic procedures. It consists of three robotic arms and a dual channel endoscope [2]. It is human operated remotely through a central console with a stereoscopic viewfinder providing the surgical field of view for the surgeon [2]. It has been used in ophthalmic surgery for anterior and posterior segment surgery such as corneal laceration repair, capsulorhexis in cataract surgery and pars plana vitrectomy (PPV) in porcine eyes. However, the device was not entirely suited for these procedures due to the lack of flexibility in the robotic arm positions coupled with increased distance between incision site and the pivot point leading to high mechanical stress on eye structures, as well as the absence of retroillumination function on the endoscope [3,4].

Several other robotic devices were invented to improve the function of the da Vinci system in ophthalmic surgery but the system with most promise is the Intraocular Robotic Interventional Surgical System (IRISS). IRISS was born out of collaboration between the Jules Stein Eye Institute and the Department of Mechanical and Aerospace Engineering at University of California, Los Angeles (UCLA) [4]. It is also human operated via a master controller console consisting of two joysticks that stimulate real intraocular surgical instruments and controlled by the surgeon. This is connected to and transmits motion signals to the slave manipulator which is made of up two independent arms that hold surgical instruments mounted on a carriage riding on a circular track [4]. A study in 2013 by Rahimy et al. showed the IRISS was successful in performing 16 intraocular procedures on porcine eyes including circular curvilinear anterior capsulorhexis, irrigation and aspiration of lens cortical material and 23-gauge PPV [4]. In 2017, Wilson et al. were able to demonstrate the use of IRISS in completing cataract surgery entirely, as well as retinal vein cannulation in post-mortem pigs eyes [5]. The latter has the potential to radicalise the way various medical retina conditions are currently managed with the delivery of drugs directly into the retinal venous circulation in addition to assisting in delicate intraocular procedures requiring access to intraretinal or subretinal space [6].

The development of these robotic surgical systems reflects the sophistication in technological advancements in the field of healthcare but it is not only limited to the surgical setting. The ophthalmology outpatient clinic environment is set to change in the coming years, especially with the implementation of artificial intelligence (AI) technology in computer devices driven by machine learning models through analysis of algorithms. This allows the devices to automatically learn and make improvements independently without the need for prior explicit programming. This feature is recognised as 'deep learning' and is akin to human intelligence, which is a cornerstone of AI [7]. One example of this in ophthalmology is the collaboration between DeepMind (an AI lab owned by Google) and Moorfields Eye Hospital to develope an algorithm for the evaluation of optical coherence tomography (OCT) scanning in diagnosing retinal conditions [8]. In the United States, an Iowa based AI diagnostics company has just received approval from the FDA for the use of its autonomous detection of diabetic retinopathy AI system known as the IDx-DR. The device is able to correctly diagnose "more than mild level diabetic retinopathy" in patients aged over 22 years. As it can be used by any healthcare provider it is hoped that IDx-DR will increase the screening rate for diabetic retinopathy, reduce the need for healthcare professionals undertaking the screening role, thus lowering healthcare costs and improving healthcare productivity [9]. The FDA has made a bold move by approving the use of IDx-DR and this is likely to pave the way for more usage of AI in diagnostics, whether in ophthalmology or other specialties, however, only time will tell if this is indeed a worthwhile and sustainable undertaking in the long term. Additionally, whilst it may seem that there is a threat to healthcare workers from the emergence of AI technology the reality is far from this. AI may be used to facilitate diagnosis, yet subsequent management of the patient's condition is far more complex than any algorithm based self-learning technology and thus it will not be able to replace the role of the physician but merely to assist [10].

This begs the question: will AI be adapted in surgical robots too? Does this mean that robots will be able to perform intraocular surgery autonomously, rendering the ophthalmologist of the future obsolete? The former proposition is likely to be inevitable in time to come whilst the latter is harder to envision, as there are still many uncertainties and limitations of AI in healthcare. Also, the current surgical robots have yet to be trialed on human eyes in real life situations where the ease with which surgery can be performed and the outcome is often affected by various patient factors. These robotic devices do still require a surgeon to operate the main console by making purposeful movements that are then mimicked by the robot. Therefore, their benefit is mainly through reducing the effect of hand tremor and improving precision [6]. For now, we can inform our patients that the closest they will get to a robotic device being used in performing their cataract surgery is femtosecond laser technology.

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