Navigating the Future Of Optometry

C-108412

Technology has been around for approx. 3million years

DEVELOPMENT OF
STONE TOOL TECHNOLOGY
IN EASTERN AFRICA

Location of Lomekwi 3 site

Lake Turkana

KENYA

ACHEULEAN
Hand axes begin to appear 1.76 MYA.

OLDOWAN
"Pebble cores" begin to appear ~2.6 MYA.

LOMEKWIAN
Earliest knapped tools discovered. Date: 3.3 MYA.

Millions of Years Ago

MAJOR EVENTS

0.5
1.0
1.5
2.0
2.5
3.0
3.5

Climate shift to 100K-year glacial cycles

Homo erectus appears in fossil record

Cooler, dryer climate in Eastern Africa

Oldest known *Homo* fossils

Oldest known stone tools

Indicates periods of large (>100K years) gaps in stone tool evidence

Image Copyrights: Acheulean, Lomekwian tools © MPK-WTAP; Oldowan tool © Turkana Basin Institute.

TURKANA BASIN INSTITUTE

Stony Brook University

Do we fear technology?

"If men learn this, it will implant forgetfulness in their souls; they will cease to exercise memory, calling things to remembrance no longer from within themselves"

Discussion Points:

- What technology do you think will shape the future of optometry/optics?

- What regulatory changes may occur due to new technology?

The New Tech...

- Advancements in diagnostic equipment: From optical coherence tomography (OCT) to wavefront aberrometry, technology continues to enhance our ability to diagnose and manage ocular conditions with unprecedented precision.

- Augmented reality in optometry: The integration of augmented reality (AR) into eyewear not only enhances the patient experience but also facilitates more accurate fitting and customization of lenses.

- Artificial intelligence in diagnosis: AI-powered algorithms are revolutionizing the diagnosis of eye diseases, enabling early detection and personalized treatment plans.

Remote Testing...

- Teleoptometry: With the rise of telemedicine, remote testing for vision assessment and monitoring is becoming increasingly prevalent. This allows patients to receive care from the comfort of their homes while expanding access to underserved communities.

- Home-based testing kits: Innovative technologies are enabling patients to perform self-administered tests for visual acuity, intraocular pressure, and more, providing convenience and early detection of potential issues.

- Challenges and opportunities: While remote testing offers convenience and accessibility, it also raises concerns regarding accuracy, patient education, and the need for regulatory oversight.

Regulatory Changes

- Expansion of scope of practice: Optometrists are increasingly being granted expanded scopes of practice, allowing them to perform additional procedures and prescribe a wider range of medications to better serve patient needs.

- Embracing digital health: Regulatory bodies are adapting to the digital age by developing guidelines for teleoptometry, remote prescribing, and the use of AI in clinical practice.

- Quality assurance and standardization: With the proliferation of new technologies and remote testing modalities, regulatory bodies are working to establish standards for training, certification, and ongoing competency assessment to ensure quality care and patient safety.

Discussion Points:

- How will AR, AI, Teleoptometry and Home Testing Kits revolutionise Optometry and what benefits/concerns do they present?

Augmented Reality

Enhanced Patient Experience:

- AR-enabled eyewear: Patients can wear AR-enabled glasses or use smartphone apps equipped with AR capabilities during their optometry appointments.

- Virtual try-on: Patients can virtually try on different frames and lens options in real-time, allowing them to visualize how different styles and prescriptions will look on their face before making a purchase decision.

- Personalized recommendations: AR technology can analyze facial features, prescription requirements, and lifestyle preferences to provide personalized recommendations for frames, lens materials, coatings, and tints.

Accurate Fitting and Customization:

- Frame fitting assistance: AR overlays digital images of frames onto the patient's face, ensuring a perfect fit by accurately measuring facial dimensions and adjusting frame size and shape accordingly.

- Lens customization: Optometrists can use AR to demonstrate various lens options and coatings, illustrating how each choice impacts visual clarity, glare reduction, UV protection, and blue light filtration.

- Prescription simulation: AR technology can simulate the visual experience with different lens prescriptions, allowing patients to compare and choose the option that provides the clearest and most comfortable vision.

Augmented Reality

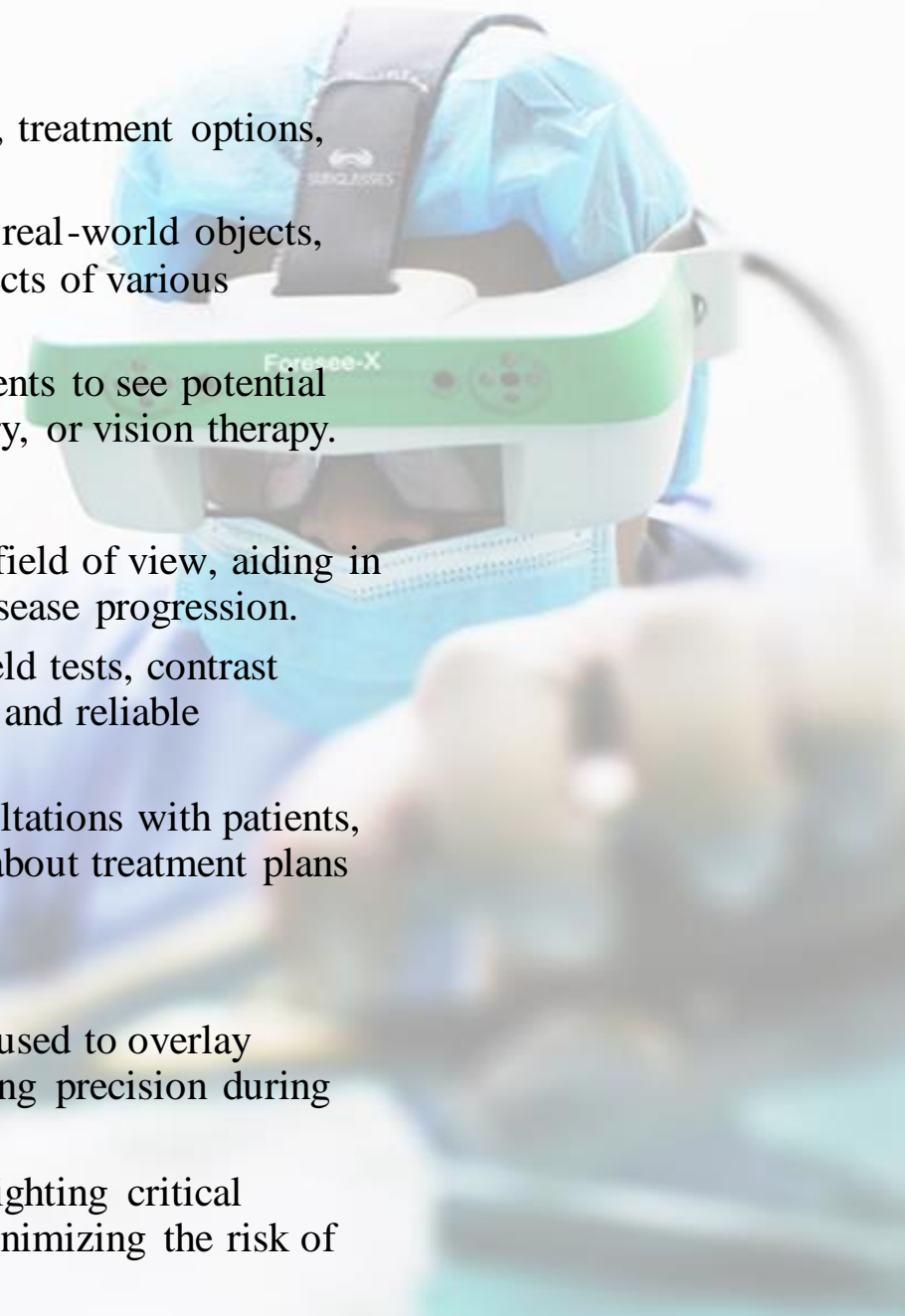**Education and Communication:**

- Visual explanations: Optometrists can use AR to visually explain ocular conditions, treatment options, and surgical procedures to patients in an interactive and engaging manner.

- Anatomy visualization: AR applications can overlay digital models of the eye onto real-world objects, providing patients with a deeper understanding of their ocular anatomy and the effects of various conditions on vision.

- Treatment planning: AR facilitates collaborative decision-making by allowing patients to see potential outcomes of different treatment modalities, such as contact lenses, refractive surgery, or vision therapy.
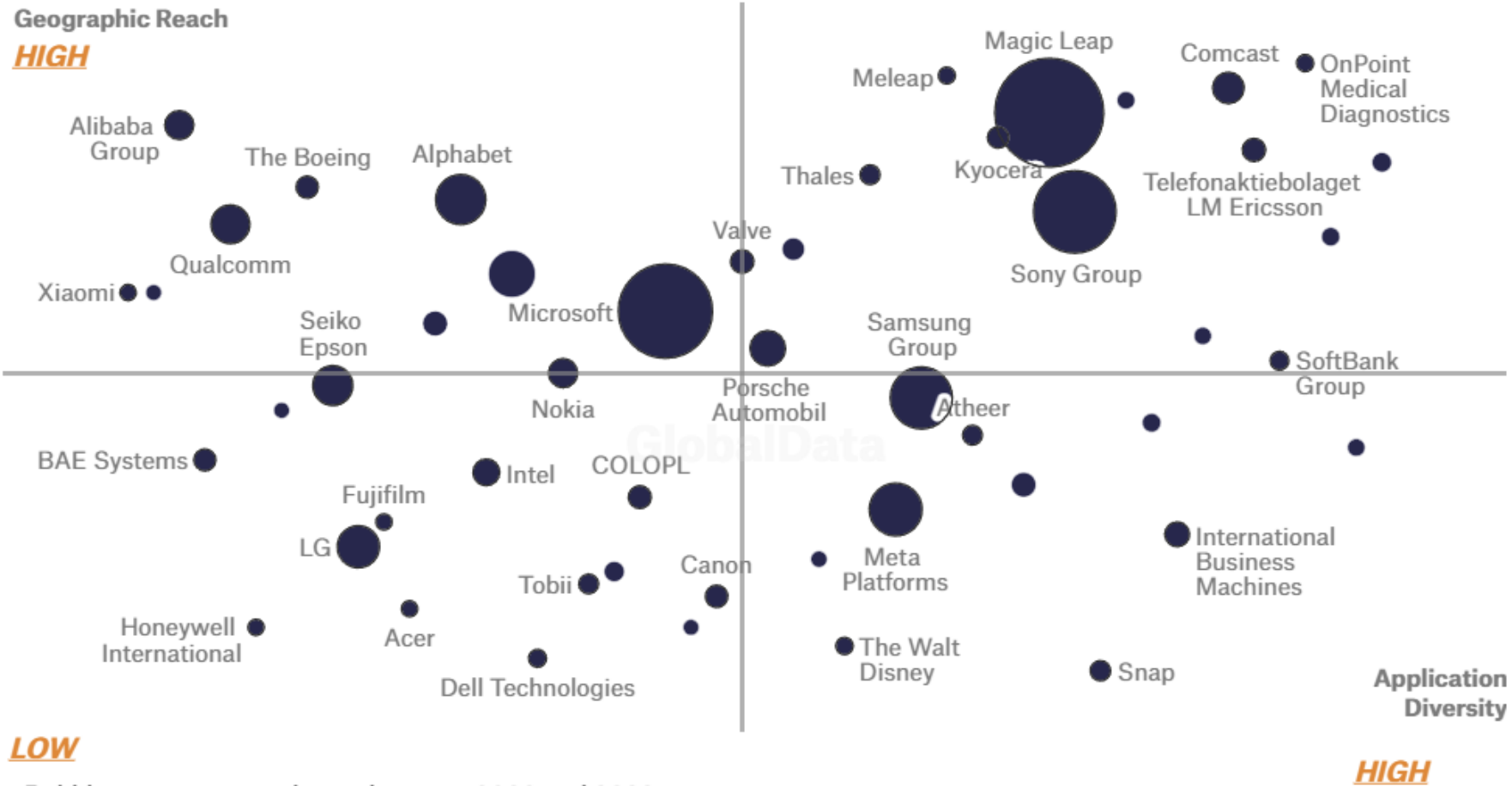
Diagnostic Support:

- Retinal imaging: AR-enabled devices can overlay retinal images onto the patient's field of view, aiding in the interpretation of findings and facilitating discussions about ocular health and disease progression.

- Interactive testing: AR applications can guide patients through interactive visual field tests, contrast sensitivity assessments, and depth perception evaluations, providing more accurate and reliable diagnostic information.

- Remote consultation: AR technology enables optometrists to conduct remote consultations with patients, allowing for real-time visualization of ocular findings and facilitating discussions about treatment plans and follow-up care.

Surgical Navigation:

- AR-assisted surgery: In advanced cases requiring surgical intervention, AR can be used to overlay surgical plans onto the patient's eye, providing guidance to the surgeon and enhancing precision during procedures such as cataract surgery or corneal transplantation.

- Real-time feedback: AR technology provides real-time feedback to surgeons, highlighting critical anatomical structures, intraoperative measurements, and instrument positioning, minimizing the risk of complications and optimizing surgical outcomes.
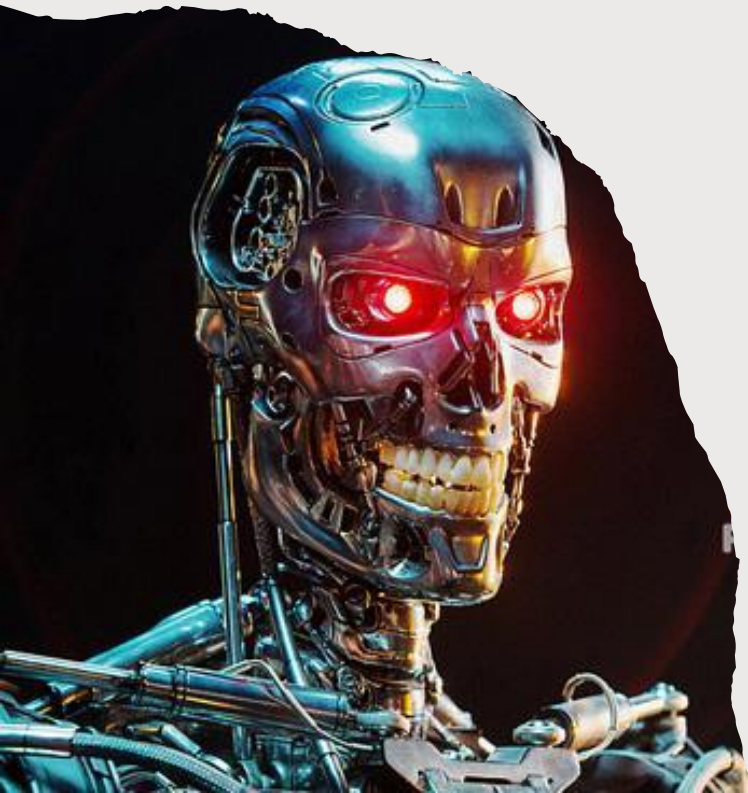
"In the last three years alone, there have been over 710,000 patents filed and granted in the medical devices industry, according to GlobalData's report on *Virtual and augmented reality in medical: AR/VR optometry*"

Artificial Intelligence

Automated Screening and Diagnosis:

- AI algorithms analyze digital retinal images to detect abnormalities such as diabetic retinopathy, glaucoma, and age-related macular degeneration.
- By comparing retinal images to vast databases of annotated images, AI can accurately identify subtle signs of pathology and prioritize patients for further evaluation.
- Automated screening using AI expedites the detection of ocular diseases, enabling early intervention and preventing vision loss.

Personalized Treatment Planning:

- AI algorithms analyze patient data, including ocular biometry, visual function tests, and medical history, to generate personalized treatment plans.
- By considering individual patient characteristics and treatment goals, AI helps optimize the selection of contact lens parameters, spectacle prescriptions, and surgical interventions.
- AI-driven treatment planning improves visual outcomes, enhances patient satisfaction, and minimizes the risk of complications.

Artificial Intelligence
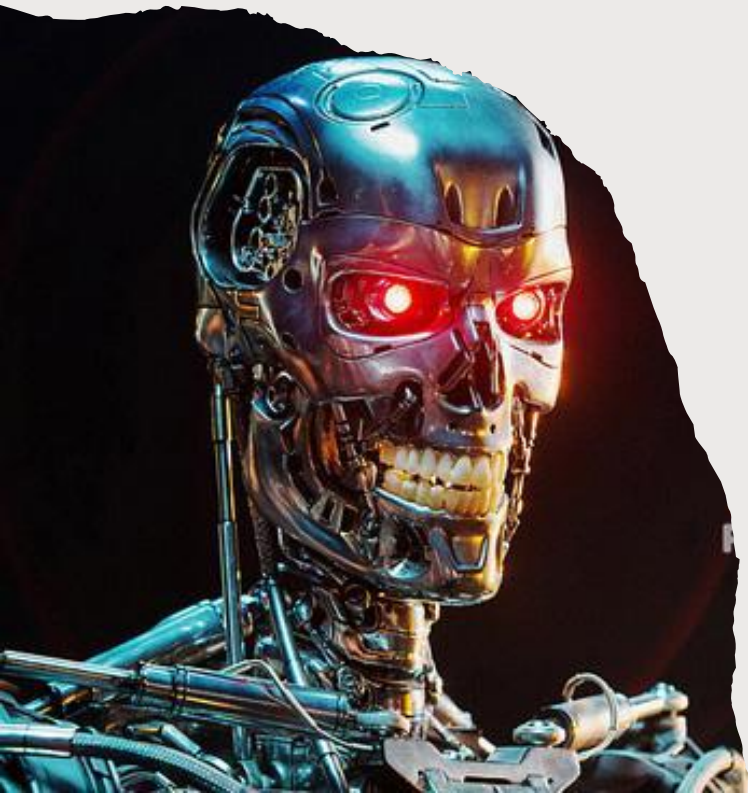
- **Predictive Analytics for Disease Progression:**
  - AI models analyze longitudinal data from electronic health records, imaging studies, and genetic profiles to predict the likelihood of disease progression in patients with chronic eye conditions.
  - By identifying risk factors and prognostic markers, AI enables proactive management strategies, including targeted monitoring, lifestyle modifications, and early intervention.
  - Predictive analytics powered by AI empower optometrists to personalize follow-up schedules and treatment regimens, optimizing disease management and preserving vision.

- **Enhanced Clinical Decision Support:**
  - AI-based clinical decision support systems provide real-time guidance to optometrists during patient encounters, offering suggestions for differential diagnosis, treatment options, and referral criteria.
  - By analyzing clinical data and evidence-based guidelines, AI helps ensure consistency in diagnostic interpretation and treatment recommendations, reducing variability in practice.
  - Enhanced clinical decision support improves diagnostic accuracy, streamlines workflow, and enhances the quality of care delivered to patients.

Artificial Intelligence
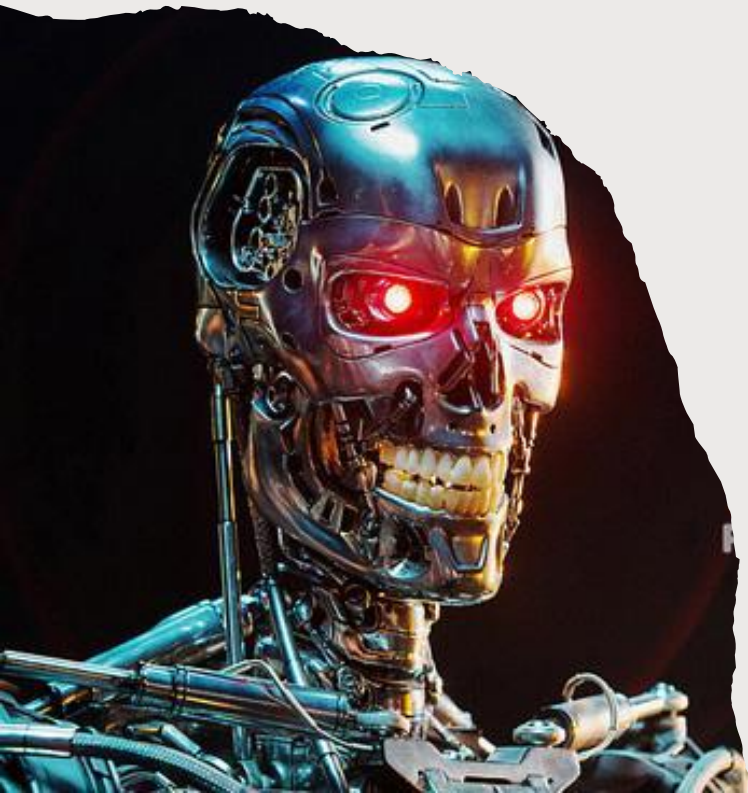
- **Image Enhancement and Reconstruction:**
  - AI algorithms enhance the quality of digital images obtained during ocular imaging procedures, such as optical coherence tomography (OCT) and corneal topography.
  - By reducing noise, improving resolution, and enhancing contrast, AI-generated images provide clearer visualization of anatomical structures and pathological features.
  - Image reconstruction using AI facilitates more accurate interpretation of imaging studies, aiding in the diagnosis and monitoring of ocular diseases.

- **Natural Language Processing for Documentation:**
  - AI-powered natural language processing (NLP) algorithms extract relevant information from clinical notes, dictated reports, and electronic health records.
  - By automating documentation tasks, NLP improves efficiency, reduces administrative burden, and ensures completeness and accuracy of medical records.
  - Optometrists can focus more on patient care and less on documentation, resulting in enhanced productivity and workflow optimization.

"A total of 400 optometrists completed the survey. The mean number of years since optometry school completion was 25 ± 15.1. Most respondents reported familiarity with AI (66.8%). Though half of optometrists had concerns about the diagnostic accuracy of AI (53.0%), most believed it would improve the practice of optometry (72.0%). Optometrists reported their willingness to incorporate AI into practice increased from 53.3% before the COVID-19 pandemic to 65.5% after onset of the pandemic"

Scanzera AC, Shorter E, Kinnaird C, Valikodath N, Al-Khaled T, Cole E, Kravets S, Hallak JA, McMahon T, Chan RVP. Optometrist's perspectives of Artificial Intelligence in eye care. J Optom. 2022;15 Suppl 1(Suppl 1):S91-S97. doi: 10.1016/j.optom.2022.06.006. Epub 2022 Sep 20. PMID: 36137899; PMCID: PMC9732481.

Teleoptometry

Virtual Consultations:

- Teleoptometry consultations take place through video conferencing platforms or specialized telemedicine software.

- Patients can connect with optometrists from the comfort of their homes, eliminating the need for travel and minimizing waiting times.

- During virtual consultations, optometrists can conduct interviews, review medical history, and assess visual symptoms to determine the appropriate course of action.

Remote Diagnostics:

- Teleoptometry platforms often incorporate diagnostic devices that patients can use at home under the guidance of a remote optometrist.

- Portable devices such as digital retinal cameras, autorefractors, and tonometers allow patients to capture images and measurements of their eyes, which are then transmitted securely to the optometrist for analysis.

- Remote diagnostic tools may also include visual acuity charts, contrast sensitivity tests, and color vision assessments, enabling comprehensive evaluations of visual function.

Teleoptometry

- **Prescription Renewals:**
  - Teleoptometry enables optometrists to renew prescriptions for glasses or contact lenses based on remote assessments of visual acuity and refractive error.
  - Patients can upload previous prescription information or undergo virtual refraction tests to determine their current visual correction needs.
  - Optometrists may also provide recommendations for lens options, coatings, and tints based on the patient's lifestyle and visual preferences.

- **Eye Health Monitoring:**
  - Patients with chronic eye conditions or at risk of developing ocular diseases can benefit from remote monitoring through teleoptometry.
  - Optometrists can review images of the retina, optic nerve, and anterior segment obtained through digital retinal cameras or anterior segment cameras to monitor changes over time.
  - Remote monitoring allows for early detection of disease progression and timely intervention to prevent vision loss.

Teleoptometry

Specialized Consultations:

- Teleoptometry extends access to specialized optometric services, particularly in underserved or remote areas where optometric expertise may be limited.

- Patients with complex ocular conditions, such as diabetic retinopathy, glaucoma, or macular degeneration, can receive expert consultations and treatment recommendations from optometrists with specialized training.

- Collaboration with other healthcare professionals, such as ophthalmologists, neurologists, or primary care physicians, may be facilitated through teleoptometry to ensure comprehensive care for patients with multisystemic conditions.

Patient Education and Empowerment:

- Teleoptometry platforms often include educational resources and interactive tools to empower patients to take an active role in their eye health.

- Optometrists can use virtual consultations to discuss preventive measures, lifestyle modifications, and adherence to treatment regimens, fostering patient engagement and compliance.

- Educational videos, interactive tutorials, and personalized care plans can be shared with patients to reinforce key concepts and promote self-management of ocular conditions.

Home Testing Kits

Visual Acuity Testing:

- Home testing kits typically include visual acuity charts or digital applications that allow individuals to measure their visual acuity at various distances.

- Patients can perform visual acuity tests using standardized charts or interactive software, following instructions provided with the kit.

- Results are recorded and can be used to monitor changes in vision over time, detect potential refractive errors, or assess the effectiveness of corrective lenses.

Intraocular Pressure Monitoring:

- Some home testing kits include portable tonometers or self-tonometry devices that enable individuals to measure their intraocular pressure (IOP) at home.

- Patients receive instructions on how to use the tonometer to obtain accurate measurements of their IOP, which is important for screening and monitoring glaucoma.

- Regular IOP monitoring at home can help detect fluctuations in pressure that may require further evaluation by an optometrist or ophthalmologist.

Home Testing Kits

- **Colour Vision Assessment:**
  - Home testing kits may include colour vision tests that assess an individual's ability to perceive and discriminate between different colours.
  - Patients are typically presented with images, patterns, or arrangements of coloured dots and are asked to identify specific colours or patterns.
  - Colour vision tests can help detect colour vision deficiencies, such as red-green colour blindness, which may affect daily activities and occupational tasks.

- **Contrast Sensitivity Testing:**
  - Some home testing kits incorporate contrast sensitivity tests to evaluate an individual's ability to distinguish between light and dark objects under different lighting conditions.
  - Patients may be instructed to view patterns or images with varying levels of contrast and indicate the smallest differences they can detect.
  - Contrast sensitivity testing can identify subtle changes in vision that may not be detected with traditional visual acuity testing alone, particularly in patients with conditions such as cataracts or macular degeneration.

Home Testing Kits

- **Self-Assessment Tools:**

  - Home testing kits may include self-assessment tools or questionnaires that help individuals identify symptoms of common eye conditions or visual disturbances.

  - Patients can use these tools to report symptoms such as blurry vision, eye fatigue, double vision, or dryness, which may indicate the need for further evaluation by an optometrist.

  - Self-assessment tools empower individuals to actively participate in their eye health and seek appropriate care when needed.

- **Remote Monitoring and Teleoptometry:**

  - Home testing kits can be integrated into remote monitoring programs or teleoptometry platforms, allowing optometrists to remotely monitor patients' vision and ocular health.

  - Patients can upload test results and digital images obtained with home testing kits to secure online portals, where they can be reviewed by optometrists for assessment and follow-up.

  - Remote monitoring using home testing kits enables timely intervention, facilitates continuity of care, and improves access to optometric services, particularly for individuals with mobility limitations or limited access to in-person appointments.

Discussion Points:

- What are the key points to consider in terms of regulation with new technology?

Possible Regulatory Changes

Expansion of Scope of Practice:

- The GOC may consider expanding the scope of practice for optometrists to encompass new technologies, procedures, and interventions that have become standard practice or are emerging as viable options for patient care.

- This could include allowing optometrists to perform additional procedures, such as certain types of minor surgeries or advanced diagnostic tests, with appropriate training and certification.

Regulation of Teleoptometry:

- With the increasing adoption of teleoptometry and remote care delivery models, the GOC may update its regulations to address the unique challenges and considerations associated with providing optometric services remotely.

- This could involve developing guidelines for teleoptometry practice, ensuring patient privacy and data security, and establishing standards for conducting remote assessments and consultations.

Possible Regulatory Changes

Integration of Artificial Intelligence (AI) and Digital Health Technologies:

- As AI and digital health technologies play a more prominent role in optometric practice, the GOC may introduce regulations to govern their use and ensure patient safety and ethical standards.

- This may include guidelines for the development and implementation of AI algorithms, standards for data privacy and informed consent, and requirements for ongoing training and competency assessment in AI-driven diagnostic tools.

Continuing Professional Development (CPD) Requirements:

- The GOC may update its CPD requirements to reflect advancements in optometric practice and ensure that optometrists remain up-to-date with the latest developments in the field.

- This could involve incorporating new CPD modules on topics such as teleoptometry, AI in optometry, digital health technologies, and emerging treatments or interventions.

Possible Regulatory Changes

Quality Assurance and Patient Safety:

- The GOC may strengthen its regulatory framework to enhance quality assurance and patient safety standards across the optometric profession.
- This could include measures to improve the monitoring and reporting of adverse events, ensure compliance with infection control protocols, and address concerns related to the inappropriate use of technologies or treatments.

Collaboration with Stakeholders:

- The GOC may engage with various stakeholders, including optometrists, ophthalmologists, industry representatives, and patient advocacy groups, to gather input and feedback on proposed regulatory changes.
- This collaborative approach ensures that regulatory decisions are informed by diverse perspectives and aligned with the needs and priorities of all stakeholders in the optometric community.

The Future Is Here...

As we look ahead to the future of optometry in the UK, it's clear that technological innovations, remote testing, and regulatory changes will continue to drive advancements in patient care and practice efficiency. By embracing these developments and adapting to changing landscapes, optometrists can position themselves as leaders in providing comprehensive eye care to their communities.

EYECARE