Ergonomic Benefits of 3D Visualization for Ophthalmic Surgeons

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BACKGROUND

- Occupational musculoskeletal disorders (MSDs) are prevalent in ophthalmic surgeons and can impact their well-being and productivity[1-3]
- The use of conventional microscopes during surgery may contribute to surgeons' pain and discomfort[4]
- 3D visualization systems can improve upon conventional microscopes by reducing ergonomic stress, with a growing body of literature demonstrating favorable ergonomics for 3D displays compared to traditional visualization techniques[5-8]

The NGENUITY® Visualization System, an example of a 3D visualization system

OBJECTIVE

- A literature review was conducted to further substantiate ergonomic benefits of 3D visualization systems for ophthalmic surgeons

METHODS

- A targeted search was performed and screened using the following strategy and criteria:

Database:	• MEDLINE
Date range:	• January 1, 2001 – May 26, 2022
Search terms:	• "ophthalmology", "cataract", "eye surgery", "ergonomics", "3D visualization", "heads-up"
Key inclusion criteria (screening):	• Reported errors and a digital technology or digital solution used in ophthalmology • English language

- Reference lists from relevant articles were also scanned

RESULTS

- Of 452 sources screen, eight studies evaluating ergonomic benefits of 3D visualization systems for ophthalmologists were identified
- Across eight comparative studies, surgeons noted benefits related to preference, comfort, muscle tone, stiffness and improved ergonomics for 3D displays compared to conventional microscopes during surgeries

In a survey of US ophthalmologists, including cataract, retinal, and glaucoma surgeons, many surgeons agreed or strongly agreed that use of a 3D display **reduced the severity (64%) and frequency (63%) of pain and discomfort, improved posture (73%), and improved overall comfort (77%)**, compared to a time using only conventional microscope[8]

A similar survey in Japan revealed that many ophthalmologists agreed or strongly agreed that use of a 3D display led to **improvements in eyestrain (54%), less pain and discomfort while operating (72%) and improvements with MSDs (63%)**, compared to a time using only conventional microscope[9]

In a consecutive case-control study of vitreoretinal surgeries in China, surgeons and residents **rated ergonomics higher in the 3D visualization group** than the conventional microscopy group using a 5-point scale (P<0.001)[5]

In a questionnaire from Malaysia, postgraduate trainees **reported significantly better experience with 3D** for eye strain (P=0.008), neck and upper back strain (P=0.000), lower back pain (P=0.019), and comfortable environment (P=0.001)[10]

A questionnaire from Saudi Arabia found that despite having significantly more hours of surgery per week than non-3D display users (P<0.001), 3D display users had similar levels of pain and their **pain did not increase when using the 3D display system**[11]

A prospective study from Korea, a quantitative measurement of retinal surgeons' muscle tone and stiffness was performed. The **intraoperative muscle tone and stiffness were higher for CM (P<0.01)**, with no difference in muscle properties post-surgery with HUD (P>0.05)[12]

CONCLUSION

- 3D visualization displays, such as the NGENUITY® 3D Visualization System, may be an important tool to promote comfort and wellness in the operating room and benefit surgeons across several ergonomic measures including:
  - ➢ Improved posture and comfort
  - ➢ Reduced neck and back pain, headaches and eyestrain
- Future studies designed to specifically compare objective methods of ergonomic assessment would be useful to provide additional information related to the value of 3D systems

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