3D Demonstration of Strabismus from Peripheral nerve neuropathies

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Abstract

Strabismus "squint eyes" is a common disorder presenting in about 2% of children born each year. While there are several causes to this presentation, we demonstrated presentation caused by Peripheral nerve neuropathies, especially the ones originating from Oculomotor (CN III) and Abducens Nerve (CN VI). The goal of this project is to create explicit 3D videos and models to be used for student and patient education. Additionally, the pathology and visual defect manifestations of the disorder were also discussed.

Introduction

Using advanced 3D rendering softwares, our goal is to explain extraocular muscle disorders in a manner that is easy for everyone to understand. Strabismus often times presents with children, and understanding the disorder is key for parents that may lead to better treatment outcomes through early intervention.

Methods

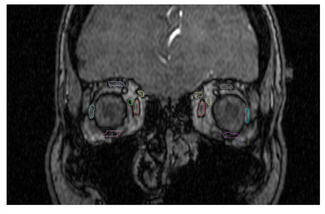

Figure 1: MRI scan used to model 3D render

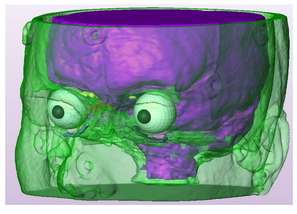

Figure 2: 3D model of head, eye, and eye muscles made using Figure 1

MRI data obtained from TCIA and analyzed in Horos DICOM viewer was exported to Amira for 3D modeling. After converting 2D image data into 3D and manually designing some anatomy by referring to Thieme Atlas of Anatomy, Meshlab was used to further enhance the visuals on the renders. Amira was used again to create animations and compose videos, which were later exported to Camtasia for further stitching and editing in order to demonstrate the different kinds of Strabismus presentations: Hypo-, Hyper-, Exo-, and Esotropias.

Results

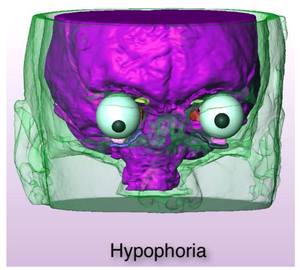

Figure 3: A 3D image of Hypotropia is shown using model eye and eyeball in Coronal view

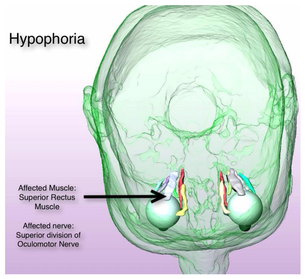

Figure 4: Figure 3 is rotated into axial view to show the affected muscle and nerve in cases of Hypotropia

Figure 5: Depicted is an example of how Hypotropia can have an affect on a patient's vision: Diplopia (double vision)

SCAN ME

Figure 6: Scan the QR Code to go to a YouTube video of different strabismus presentations

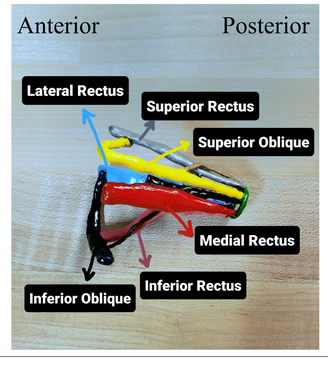

Figure 7: This is a 3D model pictured in sagittal view with extraocular muscles labeled

Discussion

The goal of this project was to make a learning tool for medical students and parents alike. Being a disorder than presents at a very young age, strabismus can not only have impacts on visual health, but also social health. Strabismus treatment has been proven to have better outcomes with early intervention, therefore, educating parents on seeking treatment early in the life of an infant is key to having the best outcomes that can avoid issues like double vision. Additionally, squint eyes can also have a negative impact on a child's day to day life. Research has shown that kids are less likely to play and make friends with "weird-looking" eyes. This negative attitude of peers among young age can negatively impact overall growth of a child.

Conclusion

Accessible 3D models for medical education has opened new ways of learning gross anatomy. With daily technological advancements, 3D visualization is even used by surgeons before performing a major surgery. Through this project, we hope to add to 3D learning by providing accessible and comprehensive teaching tool for medical students and parents.

Future Plans

The goal from here on is to make 3D models of other structures in the human body, especially ones that are rather difficult to visualize: Brain stem, Diencephalon, Prostate, etc.

Links

https://www.youtube.com/watch?v=weKu1RPLHN0

Conclusion

This research project was made possible by Marian University College of Osteopathic Medicine 3D Visualization Lab run by Dr. David Dufeau.