Brief Communication

Real-time View Mannequin Training System for Practicing Peribulbar Blocks

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Background and Aims

Most of the eye surgeries are done under regional anaesthesia, especially under peribulbar (needle) blocks. Many life and vision threatening complications have been reported to occur following regional anaesthesia. A recent series of adverse events during cataract surgery reported from Massachusetts (USA) included 5 cases of wrong eye blocks, 3 cases of haemodynamic instability, 2 cases of retrobulbar haematoma/haemorrhages, and 5 cases of permanent loss of vision due to globe perforation.[1] The Massachusetts Expert Panel survey reported the presence of a wide variation in anaesthesia practices, and needle-based blocks were used in 47.0% of cases for cataract surgery. They recommend that anaesthesiologists should perform at least 10 blocks.[1]

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However, a training system for regional ophthalmic blocks is rare or limited, and little attention is paid to allow an objective and complete out-of-the operating-room learning experience for administering ophthalmic regional block. Simulations may reduce the potential complications of needle-based blocks, and these are generally simulated on a human skull or its synthetic replica to show anatomical landmarks and to demonstrate needle trajectories. In this regard, our institutions have developed and clinically validated a real-time view mannequin training system for practicing needle-based blocks, Figure 1a.2

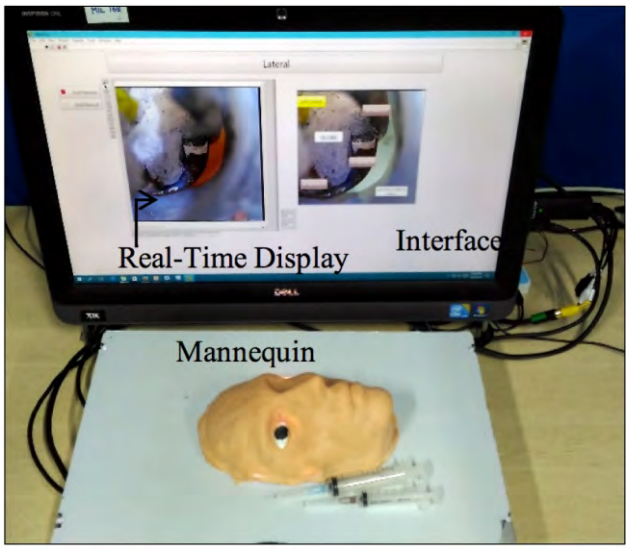

Figure 1a: Developed anaesthesia training system.

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Special Features and its uses

It provides a Human analogue replica of the normal globe, extraocular muscles, optic nerve, intraorbital space and orbital walls which helps the participants to learn more easily about the anatomy.

It provides the ability to visualize the needle track pathway inside the orbit which shows them about the spatial relationship existing between the needle, globe and the orbital walls.

It also has ability to see the angulation and needle length inserted into the orbital space which enables them to know about the degree of angulation and depth of the needle at which the globe, extraocular muscles and optic nerve are encountered.

LED indicators warnings are present for muscle proximity, angulation warning, procedural warning and for needle-globe touch.

It has sensing system of digital ocular massage.

It has innate video screen recorder which helps the participants to review their session and correct their technique accordingly, if they are wrong in approach.

Technical highlights

The Mannequin's facial features are moulded using Oomoo 30 and Dragon Skin 20, a special type of moulding rubber from a modelled anatomically accurate Human face, Figure 1b.

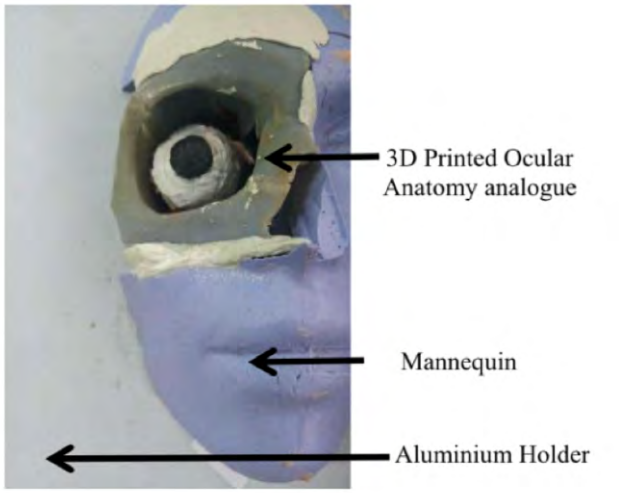

Figure 1b: Anatomically accurate modelled

The Skin is cast using a Silicone rubber. It consists of two layers to mimic the Epidermis and the Subcutaneous layer from Dragon Skin 20 and Ecofflex 0030 by Smooth-OnTM, respectively to represent the texture and feel of the human skin.

The right orbital space is replaced with the 3D modelled Human eye and the orbit.

The 3D design and printed model of globe with the extraocular muscles and orbit mimicking normal globe orbit relations.

There are two analog High Definition (AHD) camera, model number SKU VZGR1394. One is positioned at the infero-lateral position providing the lateral view visualizing the infero-lateral intra-orbital space, Figure 2 and the other one is placed in the medial position providing the view visualizing the supero-medial intra-orbital space, Figure 3. A Mux Switch circuit is used to switch between the two cameras.

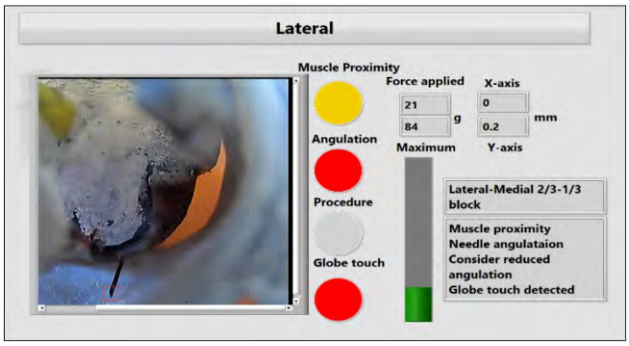

Figure 2: Lateral view with the interface showing warnings for improper angualtion, muscle proximity and globe touch

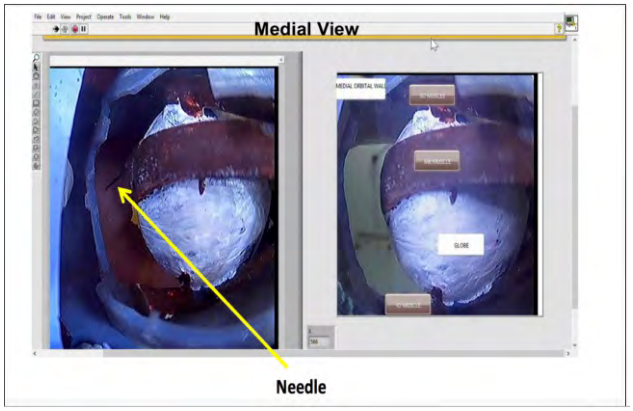

Figure 3: Medial view with the interface showing warnings for improper angualtion, muscle proximity and globe touch

The interface is on NI LabVIEW. The video is displayed using the NI IMAQ Drivers. Switching between the views is done through the interface. A needle position tracking algorithm tracks the position of the needle within the orbit and provides appropriate warnings, Figure 2.

The system uses resistive and magnetic sensors for occular digital massage, the same NI LabVIEW interface is used to show the appropriate warnings, Figure 2.

Limitations

Abnormal globe:orbit conditions like deep set (shrunken) globe, forward set globe, myopic eyes etc were not simulated. However provision are such that these structures can be obtained with simple substitution.

Future scope

In future, integration and simulation of the major vessels inside the orbit like ophthalmic artery and venous plexuses will be done.

Simulation of the abnormal globe:orbit conditions to learn performing eye blocks in these challenging cases will also be done.

Conclusion

This type of training system by providing visual and physical feedback is novel to the ophthalmic anaesthesia training. It can be utilized as a teaching module as well as a practicing tool to perform peribulbar blocks correctly. This in turn can enable ophthalmologists/ anaesthesiologists especially the trainees to administer a safe regional anaesthesia in their patients.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

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2. Visual Feedback Enabled Training Mannequin for Ophthalmic Blocks: an Evaluative Study. Nimal J. Kumar, Jaichandran V V, Bobby George, Mohanasankar Sivaprakasam. IEEE.org 2018 DOI: 10.1109/CIBEC.2018.8641833.

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