

CIS II Background Reading Report

Project 17: Actuation Design for Loop Snare Operation in Eye Surgery

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Introduction

The team is developing a loop snare inside the CIS II project. Unlike the usual function of the loop snare, which is to grab and cut in the patient body, the project mainly uses the loop snare as an operational guidance inside the eye, which it has a spherical shape. With the help of the flexible provided by the loop snare, the doctor will obtain a pathway to access the backside of retina with minimal destruction to deliver the required medicine to cure the disease at the location.

The team chooses a reading that closely connected to the aspect of drug delivery to the retina. The title of the report is *Ocular Drug Delivery to the Retina: Current Innovations and Future Perspectives*. The author of this report is Hyeong Min Kim and Se Joon Woo. The paper is published on 15 January 2021 on the pharmaceutics. The reason that the team choose this paper is that in this paper, the authors introduce current methods in delivering medicine to different part of eye. It provides fairly board information in those delivering methods and their corresponding drug that can be used by each operation. The authors also provide their perspective on the future development of drug delivering methods.

What the team is doing for this semester is to define an interface that can be latter used as the actuation part of a drug delivering method, which there is no existing methods uses this type of approach.

The second paper the team chooses is *Bioengineering strategies for restoring vision*. The authors are Jasmina Chehajic-Kapetanovic, Mandeep S. Singh, Eberhart Zrenner, and Robert E. MacLaren. This paper is directly provided by Dr. Singh to the team as a reading to gaining more information on the topic. The paper is published on nature biomedical engineering on the date of 31 Jan 2022. The connection to this CIS II project is that the finished snare loop robot will be used to deliver stem cells to the backside of retina, which can be concluded as a way of performing cell therapies.

Technical Summary

In this section, the team will be focusing on the topics that closely connected to the project foundation as described in the introduction. The following paragraph will be the technical summary of the first paper the team introduced: *Ocular Drug Delivery to the Retina: Current Innovations and Future Perspectives*.

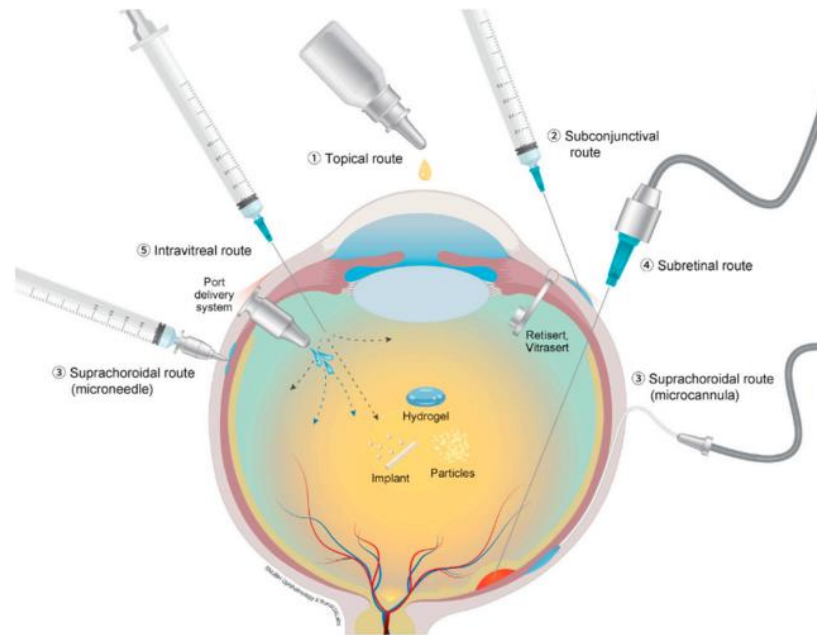


Figure 1. Current methods for delivering drug

The above figure is the figure used in the paper to show the methods can be used in delivering drugs to the different portion of the eye. Inside these methods, the one method that hold similarity is the method called subretinal route (route No. 4). This type of method is very useful as it enables direct drug effects on subretinal space cells and the retinal layer. Recently, subretinal injections have been used to treat inherited retinal diseases, ultimately delivering genes directly to the RPE and photoreceptor cells and to gain long-term gene expression in vivo. These above figures can also be concluded as the pros for this type of drug delivering method. Another pro can be concluded as that it does not requires a complicated system, which it requires surgical microscope, drug administration can be performed with direct visualization. While compared to what the finished product, the finished system should also require a visualization method that might need to be introduced to visualize the safe space between the retina and choroid. The con for this method is that the injection will create damage on the retina and the photoreceptor cells, which might result

in a longer period of recovery for the patient.

As mentioned in the last section that the finished product will provide an interface for the retinal cell therapy. Based on the information obtained from the second paper: *Bioengineering strategies for restoring vision*, retinal cell therapy is envisioned as a future treatment for degenerative retinal diseases. Intraocular delivery of cell-based therapeutics is being developed to preserve or restore vision in people with a wide range of degenerative retinal diseases, including those with monogenic or multifactorial aetiology. In the previous section, the team mention that there is no existing method that can deliver cells and perform therapy by this approach. This statement can be proven by the existing methods that list in this paper. Since this paper is summarizing the different ways in cell therapy, the team can not actually conclude any pro and con for this paper. But this paper states clearly that there is a clear future for this therapy.

Reference

Cehajic-Kapetanovic J, Singh MS, Zrenner E, MacLaren RE. Bioengineering strategies for restoring vision. *Nature biomedical engineering*. January 2022. doi:10.1038/s41551-021-00836-4

Kim HM, Woo SJ. Ocular Drug Delivery to the Retina: Current Innovations and Future Perspectives. *Pharmaceutics*. 2021;13(1). doi:10.3390/pharmaceutics13010108