Introduction

Glaucoma is an ocular disease in which there are increased intraocular pressure levels within the eye causing eventual damage to the optic nerve and loss of vision. The intraocular pressure level is set by a balance between production of the aqueous humor fluid in the eye and its outflow through the trabecular and uveoscleral pathways. According to the Glaucoma Research Foundation, glaucoma is the leading cause of irreversible blindness world-wide with no cure available as of now. The only option patients have to treat glaucoma is instilling prescribed glaucoma medications like eye drops into their eyes to reduce the intraocular pressure levels. This concludes in a small amount of the medication absorbed, and the effects of the medication are not prevalent. Likewise, case studies show that glaucoma patients regularly forget to insert their eye drops, and also have difficulty in administering their eye drops daily. Drug-dispensing contact lenses have the potential to become the next revolutionary medical innovation because of their ability to elute a drug from the polymer film within which increases bioavailability, hence reducing drug wastage. With this, glaucoma patients will have lower patient non-adherence rates and the lenses as a whole will help decrease the progression of the glaucoma disease.

Lenses in development have latanoprost in them, but another widely used drug, timolol, might be an effective option for glaucoma patients who do not respond to latanoprost because they have uveitic glaucoma or they don't want to experience any of latanoprost’s ocular side effects such as change in iris color and lengthening of eyelashes.

Methods

A variety of biomedical and pharmaceutical research articles from multiple journals in Biomaterials, Expert Opinion on Pharmacotherapy, Eye, and more were utilized to heavily research and analyze this research topic. Different journal articles were compared and contrasted against each other to achieve the best results from them. In addition, previous studies on latanoprost and timolol and their role in glaucoma medications were used as background information.

Results

1) Systemic Adverse & Ocular Side Effects Contrast

Timolol has systematic adverse side effects such as cardiac arrhythmias and severe bronchospasms, syncope, cerebrovascular events, heart failure, depression, states of confusion, and impotence. On the other hand, latanoprost has ocular side effects such as increased iris pigmentation, growth of eyelashes, change in iris color, stinging, blurred vision, eye redness, itching, and burning.

Many people who use timolol do not experience its more serious side effects while latanoprost's ocular side effects are more likely to occur in glaucoma patients. If they do experience timolol's more serious side effects, it is mostly likely due to drug interactions with other drugs patients are taking at the same time.

2) Cost Comparisons and the Effect of Socioeconomic Status

Timolol is less expensive to buy compared to latanoprost since beta-blockers, a class of drugs that latanoprost falls under, are generally inexpensive unlike prostaglandins, a class of drugs that latanoprost falls under. The difference in price, however, does not undermine timolol’s ability as an efficient glaucoma drug because people living at a lower socioeconomic class have higher rates of glaucoma and need access to an intracocular pressure lowering drug like timolol.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Wholesale Price</th>
<th>Mean IOP Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latanoprost</td>
<td>$66.98</td>
<td>2.8 mm Hg</td>
</tr>
<tr>
<td>Timoptic</td>
<td>$22.10</td>
<td>3.6 mm Hg</td>
</tr>
</tbody>
</table>

3) Drug Release Rates Comparison

Timolol has comparable, extended drug release rates like those of latanoprost which leads to lower intraocular pressure levels in the eye. The lower intraocular pressure levels in the eye contribute to a slower progression of the glaucoma disease in the eye. For glaucoma patients who cannot take latanoprost because they have uveitic glaucoma or they don’t want to experience any of latanoprost's ocular side effects such as change in iris color and lengthening of eyelashes, this is an effective choice since its drug release rates are like those of latanoprost.

When timolol is in commercial contact lenses, the rate at which the drug releases is equivalent to latanoprost. According to Ciolino et al., the drug release latanoprost produces is 3 days while timolol approximates to four days in Peng et al.’s study which is similar. Accordingly, in Guidi et al.’s study the timolol release estimates to be about 2 days which is analogous to latanoprost in Ciolino et al.’s study.

Conclusions

According to the Glaucoma Research Foundation’s website, 20% of patients have uveitic glaucoma. These patients cannot use latanoprost as their glaucoma medication because they do not respond to it with their specific type of glaucoma. While we know that timolol in contact lenses models such as drug-soaking, in vitro and in vivo, and nanoparticle loading have comparable drug release rates like that of latanoprost, we can correlate that timolol will have similar rates in drug-dispensing contact lenses.

Further Studies

- Experimental drug trials need to be conducted to see whether timolol has equivalent drug release rates in drug-dispensing contact lenses.
- Drug-dispensing contact lenses need to be studied in clinical trials so that the Federal Drug and Food Administration can approve them for use.
- Other types of glaucoma such as open-angle, angle-closure, normal-tension, and congenital need to be studied to see which glaucoma drug works best for each one.

Works Cited


Acknowledgements

I would like to thank the Undergraduate Research Opportunities Program, Mary Boyes, and the Honors College for their support and resources to let me take part in this academic research project.