Correlates of Subjective and Objective Measures of Ocular Discomfort

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Introduction

- The success of contact lens wear is determined by the subjective comfort experienced with the lenses.
- Comfort with contact lens wear is generally assessed using subjective rating scales like visual analogue scales1 or numerical rating scales2. No objective anchor/measure has been established for the discomfort experienced on the ocular surface.
- Non contact pneumatic esthesiometry3 provides a way to produce discomfort on the ocular surface by delivering pneumatic stimuli systematically varying flow rate to produce a corresponding weak to strong sensation of discomfort.
- Psychophysical scaling methods help to quantify these sensations and relate the quantitative measures of sensation to the quantitative measure of physical stimuli.
- Magnitude matching4 is a psychophysical scaling method enabling subjects to adjust the intensities of qualitatively different stimuli so their sensation magnitudes match.

Materials & Methods

- Subjective measurements of discomfort were obtained using numerical rating scales with 0 indicating no discomfort and 100 indicating worst discomfort imaginable.
- The central corneal mechanical threshold was first measured using the ascending method of limits.
- The assigned contact lens was fitted on one eye and the equivalent corneal discomfort was matched on the fellow eye using stimuli delivered from the esthesiometer.
- Participants rated the discomfort arising from the pneumatic stimuli and the contact lens discomfort.
- Stevens’ power functions5 were used to examine the relationships between the objective esthesiometer stimulus match to the subjective sensation reported with the contact lens.
- Pearson product moment correlation was used to correlate the objective esthesiometer stimulus intensity to the subjective ratings of discomfort reported by each participant.

Results

- 14 out of 27 participants showed statistically significant correlation between the subjective and objective measures of discomfort (correlation ranged from 0.71 to 0.89). The remaining subjects showed a correlation between -0.04 to 0.70, which were not statistically significant.
- Non Linear regression was used to fit the discomfort with contact lenses and the corresponding intensity of pneumatic stimuli that produced equivalent discomfort, using Stevens power function:

\[ \Psi = K (\Phi) \]

where \( \Psi \) is the subjective magnitude of discomfort, \( \Phi \) is the strength of the pneumatic stimuli causing the discomfort. \( K \) is the constant and \( b \) is the power exponent.
- The average exponent for the power function relating the subjective and objective measures of discomfort was 1.40
- The relationship between the subject sensation with contact lenses and the objective stimuli from esthesiometer appears to follow Stevens’ power law in half of the participants.
- Inter-individual differences do exist in this type of sensation magnitude estimation. These may be due to differences in judgmental and sensory processing.5,6
- Differences in numeric response preference such as the influence of absolute numbers chosen, range of numbers used and whether the numbers are linearly applied to the sensation magnitude also perhaps play a role in magnitude matching experiments5.

Conclusions

- Subjective ratings of ocular discomfort can be scaled by corneal esthesiometry in a selected sample of people.
- In the subset of subjects with poorer correlations, perhaps the pneumatic mechanical stimulus was too localized and specific to match the complex sensations experienced while wearing contact lenses.
- However, there is also a group of subjects who are poor at making judgments about ocular comfort. Perhaps sensory panels should be used when ocular discomfort is the primary outcome.

References

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