JOJ Ophthalmology
ISSN: 2473-5477

Juniper Publishers
key to the Researchers

Research Article
Volume 9 Issue 1 - October 2021
DOI: 10.19080/JOJO.2021.09.555751

JOJ Ophthalmol

Accommodative Demand for Commercial Airline Passengers (Your Eyes, as well as your Knees, are likely to be More Comfortable When Flying First Class)

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Submission: September 14, 2021; **Published:** October 22, 2021

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Abstract

Purpose: Video screens have become common on commercial airlines. The screens are usually positioned in the seatback subjecting passengers to potentially onerous accommodative demands. This paper is a preliminary investigation of accommodative demand for commercial airline passengers.

Methods: Information on the seat pitch (distance between seats), seat height and amount of seat recline was obtained from the 3 major airplane manufacturers, from airline websites, and from independent consumer sites. Also, the author measured the actual distance from the seat screen to his spectacle plane on four different airplane flights. Based on the information and upon assumptions of average seatback thickness and the anterior-posterior head dimensions, accommodative demand was calculated for various seating and viewing scenarios.

Results: The accommodative demand created by video screens in eye-level position for economy seats ranges from 2.50D (for the most crowded seating arrangements) to 1.50D. Business and first-class travelers have a maximum demand of 1.50D. Ofter it is less, as low as 0.75D.

Conclusion: The calculated accommodative demand is not unreasonable for non-presbyopes for all passenger conditions. Presbyopes in crowded economy seating without single vision reading glasses, are at potential risk for asthenopic symptoms and neck pain.

Keywords: Accommodation; Airline seating; Asthenopia

Introduction

Airlines are trying to maximize their profits seemingly any way they can. Especially since the COVID crisis many formerly free services are now only available for a fee [1]. Fitting ever more passengers onto flights is a very significant driver of income. This trend has led to publicized accounts of passenger disturbances over seat crowding and reclining seat encroachment [2,3].

As video screens (usually positioned in the seatback) are becoming ubiquitous on commercial airlines while more and more seats are being crowded into planes [4], passengers may be subjected to troublesome accommodative demands to see the video screens clearly. Seat pitch is the distance between a point on a seat and the same point on the seat in front of it. It gives a rough approximation of legroom. For comparison, Delta Airlines has some first-class seats with 38-inch pitch (96.5cm) [5]. When American Airlines launched the recently troubled Boeing 737, they originally considered shortening the seat space to 28 inches (71cm). Due to an outcry in the travel industry, they ended up setting their seat configuration with 30inch (76cm) seat pitches for economy class [6]. Seat pitch has gone from an average of 32-35 inches (81-89 cm) in the 1990s to 30-32 inches (76-81 cm) in 2014. Today the seat pitch is as low as 28 inches (71cm) [5]. There has been no literature or discussion on the effects on accommodative demand as a consequence of the shortened distance between seats. This paper is a preliminary investigation of the issue of accommodative demand for commercial airline passengers.

Methods

Information on the seat pitch (distance between seats), seat height and amount of seat recline was obtained from the 3 main airplane manufacturers (Airbus, Boeing, and Embraer) [7-9]. (It turns out seat pitch is not the manufacturer's doing, but how the individual airlines choose to configure the seating.) from airline

websites [10-12], and from independent consumer sites [1,13]. Based on the information and upon assumptions of average seatback thickness and the anterior-posterior head dimensions, accommodative demand was calculated for various seating and viewing scenarios. In addition to the calculated scenarios, the author measured the actual distance from the screen to his spectacle plane on four different flights.

Results

The accommodative demand created by video screens in eye-level position for economy seats ranges from 2.50D (for the most crowded seating arrangements) to 1.50D. Business and first-class travelers have a maximum demand of 1.50D. Often it is less, as low as 0.75D. The placement of the screens at eye-level is fine for non-presbyopes but requires an unusual head tilt for presbyopes to see it clearly. Increase accommodative demand only exacerbates the difficulty. The vergence system is also stressed by the unusual head position and the proximity of the viewing target. Hand-held personal devices (phones, i-pads, Kindles™), although allowing a more comfortable head position, give increased demand. If the passenger in front has their seat laid back, the personal device may have to be held as close as 25cm, resulting in a 4D accommodative demand.

Discussion

As usual, youth has its advantages. A non-presbyope with a decent accommodative/binocular system can comfortably view a video screen embedded in the back of the seat in front of them. For those wearing multi-focal spectacles designed for standard viewing, they either would have to tilt their head up to be able to use their add or be fortunate enough to have some useful residual accommodation. Especially for economy class passengers, moderate and higher presbyopes are at risk for ocular asthenopia &/or neck pain. Single vision near spectacles would avoid the head and neck positioning difficulties inherent in viewing a screen approximately the same height as their eyes when seated as a passenger. The calculated accommodative demand is not unreasonable for non-presbyopes for all passenger conditions. The seating configuration when using a hand-held viewing device requires a short working distance/high accommodative demand. If the presbyope's add is not high enough, again, problems could ensue.

Conclusion

Airline passengers (especially those in crowded "economy" class) who are moderate and higher presbyopes, are at risk for ocular asthenopia &/or neck pain. It may be prudent to consider single vision near only spectacles for frequent airplane travelers.

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DOI: 10.19080/JOJO.2021.09.555751

How to cite this article: Kenneth R S. Accommodative Demand for Commercial Airline Passengers (Your Eyes, as well as your Knees, are likely to be More Comfortable When Flying First Class). JOJ Ophthalmol. 2021; 9(1): 555751. DOI: 10.19080/JOJO.2021.09.555751