Intraocular lens in a fighter aircraft pilot

Anat Loewenstein, Orna Geyer, Yoram Biger, Rivka Bracha, Igal Shochat, Moshe Lazar

Abstract
A pseudophakic pilot of the Israeli air force flying an F-15 (Eagle) aircraft was followed up for three years. He experienced about 100 flying hours, 5% of the time under high g stress. The intraocular lens did not dislocate and no complications were observed. It seems that flying high performance fighter aircraft is not contraindicated in pseudophakic pilots.

In the past the development of cataract has ended a pilot’s flying career. Aphakic glasses cause a 33% magnification of objects and a severe visual field restriction; they are thus unsuitable in the flight environment. Contact lenses have the potential complications of a foreign body in the eye and are limited by a variable ocular tolerance and wearing time. Dust and particles floating around, wind blast, possible loss, and the nuisance of removing, cleaning, and reinserting make the contact lens less than ideal for the military environment. There are few data on pseudophakic pilots. The largest series deals with 75 commercial and private pilots1 in whom the main problem is loss of accommodative ability, necessitating near correction. In pilots of high performance fighter aircraft the vibration and acceleration which generate high gravitational forces cause an additional risk of IOL dislocation. To the best of our knowledge the safety of IOL implantation in high g aviators has not been reported. As to hard contact lenses, it was found that a significant hazard exists owing to the risk of decentration and dislodgement from the eye.2 Soft contact lenses on the other hand were not found to be subject to decentration.3 On a human centrifuge Forge and Meek4 tested soft contact lenses up to +9 g and found small amounts of decentration which they believed would not interfere with vision. Also on a human centrifuge Brennan and Girvin5 found that soft contact lenses were displaced by a maximum of 1-5 mm when exposed to acceleration forces of +4 g and by 1-75 mm when exposed to +6 g. The decentration was more marked in soft toric lenses as a result of their heavier weight.

The effect of high g stress on IOLs has been studied only in monkeys by Tredici (personal communication). He implanted them in the anterior and posterior chamber of monkeys and exposed them to +12 g on a centrifuge. The IOLs did not dislocate and no complications were observed. These studies encouraged us to allow our patient to return to full flight activity. It seems that flying high performance fighter aircraft is not contraindicated for pseudophakic pilots.

Discussion
The reported cases of IOL implantation in pilots are summarised in Table 1. The largest series is of private and commercial pilots1 in whom the main problem is loss of accommodative ability, necessitating near correction. In pilots of high performance fighter aircraft the vibration and acceleration which generate high gravitational forces cause an additional risk of IOL dislocation. To the best of our knowledge the safety of IOL implantation in high g aviators has not been reported. As to hard contact lenses, it was found that a significant hazard exists owing to the risk of decentration and dislodgement from the eye.2 Soft contact lenses on the other hand were not found to be subject to decentration.3 On a human centrifuge Forge and Meek4 tested soft contact lenses up to +9 g and found small amounts of decentration which they believed would not interfere with vision. Also on a human centrifuge Brennan and Girvin5 found that soft contact lenses were displaced by a maximum of 1-5 mm when exposed to acceleration forces of +4 g and by 1-75 mm when exposed to +6 g. The decentration was more marked in soft toric lenses as a result of their heavier weight.

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It seems that flying high performance fighter aircraft is not contraindicated for pseudophakic pilots.

Table 1 Summary of reports on IOL implantation in pilots

<table>
<thead>
<tr>
<th>Author</th>
<th>Aircraft</th>
<th>No.</th>
<th>Type</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mader et al5</td>
<td>Helicopter pilots</td>
<td>8</td>
<td>Ant. chamber-2</td>
<td>Glare, erythropsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Post. chamber-5</td>
<td>Glare, erythropsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Iris supported-1</td>
<td>Cystoid macular oedema</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not reported</td>
<td>Glare, altered colours</td>
</tr>
<tr>
<td>Liddy et al6</td>
<td>Airline transport pilots</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial pilots</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flight engineer</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3 Flynn WJ, Block MG, Tredici TJ, Provinces WG. Effect of positive acceleration (+Gz) on soft contact lens wear. Aviat Space Environ Med 1987; 58: 581-7.
6 Forge RE, Meek LF. The movement of soft contact lenses on the human eye exposed to +Gz acceleration. Downview, Canada: DCEIM Report No. 80-R-49.
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