

# CORRECTION OF ASTIGMATISM WITH CONTACT LENSES

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**SUMMARY** – Contact lens correction of astigmatism is reviewed. According to literature data, rigid gas permeable lenses are the lenses of choice in correction of irregular and high astigmatism. The crucial advantage of rigid gas permeable lenses is clear vision and stable correction of astigmatism. Soft toric lenses ensure quick adaptation and comfort. The most prominent disadvantage of soft toric contact lenses is variable visual acuity caused by lens rotation.

**Key words:** *Contact lenses; Astigmatism*

Astigmatism occurs when the rays of light entering the eyes focus on two planes. It may be the result of different causes: variation in the shape of the cornea, partial dislocation of the lens, or a toric crystalline lens.

Residual astigmatism is the amount of astigmatism that remains after a lens has been fitted to the cornea. The most common source is lenticular astigmatism.

Over 25% of all patients interested in contact lenses demonstrated astigmatism over 1.25 D.

In a large study group (20,000 eyes), 45% of corrected eyes had astigmatism higher than 0.75 Dcyl and 2% of eyes had astigmatism higher than 3.0 Dcyl according to Holden<sup>1</sup>.

There are a number of options in correcting astigmatism: soft lenses or rigid gas permeable lenses, either spherical or toric.

Why should we prefer rigid gas permeable (RGP) lenses? With RGP lenses patients will achieve the best visual acuity with the lowest risk of infection, good lens durability and acceptable cost. As reported by Michaud *et al.*, "... most of the subjects preferred rigid contact lenses because of the quality of their vision"<sup>2</sup>.

Types of RGP lenses for astigmatism correction are as follows<sup>3</sup>: spherical lens for astigmatism under 3.5 Dcyl; back toric lens used when corneal toricity is greater than 3.5 Dcyl; front toric lens used in patients with spherical cornea and lenticular astigmatism; and bitoric lens used when refractive astigmatism is greater than 3.5 Dcyl and is caused by both corneal toricity and lenticular astigmatism.

RGP lenses are irreplaceable in irregular and high astigmatism, in patients with complications after corneal transplantation and refractive surgery, and in patients with keratoconus. The study by Jupiter and Katz demonstrated that irregular astigmatism was much better corrected with RGP lenses than with glasses<sup>4</sup>.

Patients with 20/20 spectacle visual acuity achieved, on average, no improvement in visual acuity with RGP contact lenses. Patients with 20/25-20/30 spectacle visual acuity achieved a one line average improvement. Patients with 20/40 spectacle visual acuity achieved a two line average improvement. Patients with 20/50-20/200 spectacle visual acuity achieved a four line average improvement and patients with spectacle visual acuity of 20/400 achieved a six line average improvement<sup>4</sup>.

Patients with visual problems after refractive surgery were also the subject of investigations. Astin *et al.*<sup>5</sup> evaluated contact lens fitting and longer term response of the photorefractive keratectomy (PRK) cor-

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nea to lens wear. In PRK for myopia, problems such as irregular astigmatism, regression, anterior stromal haze, halo aberration, and anisometropia were reported. Some patients therefore required contact lens correction to obtain best corrected visual acuity (BCVA). In most cases, contact lenses gave good visual acuity and, in cases of mild irregular astigmatism, significant improvement over spectacle BCVA<sup>5</sup>.

A group of patients after unsuccessful refractive surgery were fitted with RGP lenses to achieve better visual acuity. The main outcome variables in determining success were visual improvement, contact lens tolerance, fitting characteristics and wearing time. Of 42 eyes, the contact lens visual acuity was better than spectacle acuity in 25 (59.5%), equal in 14 (33.3%) and worse in three (7.1%) eyes. A total of 33 (78.6%) eyes were still wearing their lenses at the last visit. Contact lenses can be a valuable method of managing poor visual acuity after refractive surgery<sup>6</sup>. Ada and Lipener achieved better visual acuity (>20/40) in 60% of patients fitted after previous LASIK<sup>7</sup>. Alió *et al.* achieved even better results in their group of patients fitted with RGP lenses after unsuccessful previous refractive surgery (79.3%)<sup>8</sup>.

In patients with undesirable results after corneal refractive surgery, reverse geometry contact lenses could be used instead of surgical retreatment. A reverse geometry lens has a flatter base curve than the corneal curvature, in order to accommodate the shape of a post-refractive cornea. Both RGP and a few specialty soft lenses are available in this design.

The flatter central curvature (base curve) creates a thinner tear film and eliminates troublesome air bubbles from being trapped inside the central part of the lens. It also helps prevent troublesome post-wear myopic blur. The last thing a post-refractive surgery patient wants to experience is worse vision upon lens removal than previously. Just as the reverse curve can prevent myopic blur, it can also help reduce or eliminate corneal distortions and under-corrections. In a study by Martin and Rodriguez, improvement for two lines was achieved in 55% of patients compared to glasses<sup>9</sup>.

Soft contact lenses could be a good alternative for astigmatism correction in contact lens wearers. Patients have short adaptation period, lenses are com-

fortable with wide visual field and negligible aniseikonia. The number of complications is reduced with frequent replacement, and oxygen supply is very good with silicon-hydrogel lenses<sup>10</sup>. It is estimated that approximately one third of potential soft contact lens wearers require astigmatic correction<sup>11</sup>.

The mechanisms used to stabilize a toric soft contact lens are: truncation, dynamic stabilization (dual-thin zone), prism ballast, back surface toricity, and combinations of these techniques. Both low-astigmatic and moderate-astigmatic eyes showed significant improvements in acuity with toric contact lenses<sup>12</sup>.

In a study by Kurna *et al.*<sup>13</sup>, two groups of astigmatic patients were fitted with soft spheric lenses (<0.75 Dcyl group and 0.75-1.25 Dcyl group). Another two corneal astigmatism groups were fitted with soft toric contact lenses (0.75-1.25 Dcyl group and >1.25 Dcyl group). Success of contact lens fitting was evaluated by three parameters: astigmatic neutralization, visual success, and retinal deviation.

It was clearly shown that spherical lenses failed to mask corneal toricity during topography, while toric lenses caused central neutralization and decrease in corneal cylinder in low- and moderate-astigmatism eyes.

Contrast sensitivity provided by a toric contact lens showed better results *versus* spherical equivalent lens in a patient with borderline to moderate astigmatism<sup>14</sup>.

In conclusion, RGP lenses are the lenses of choice in the correction of irregular and high astigmatism. The crucial advantages of RGP lenses are clear vision and stable correction of astigmatism. Soft toric lenses ensure quick adaptation and comfort. The most prominent disadvantage of soft toric contact lenses is variable visual acuity caused by lens rotation.

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#### Sažetak

### ISPRAVLJANJE ASTIGMATIZMA KONTAKTNIM LEĆAMA

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U članku se pregledno iznose mogućnosti korekcije astigmatizma kontaktnim lećama. Prema literaturnim podacima tvrde plinopropusne leće su leće izbora u ispravljanju nepravilnog i visokog astigmatizma. Ključne prednosti tvrdih plinopropusnih leća su jasan vid i stabilna korekcija astigmatizma. Mekane torične leće osiguravaju brzo navikavanje i ugodu pri nošenju. Najznačajniji nedostatak mekih toričnih leća je promjenjiva vidna oštrina uzrokovana rotacijom leće.

Ključne riječi: *Kontaktne leće; Astigmatizam*

