CONTACT LENS FITTING IN 133 EYES WITH IRREGULAR ASTIGMATISM

ADAPTACIÓN DE LENTES DE CONTACTO EN 133 OJOS CON ASTIGMATISMO IRREGULAR

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ABSTRACT

Purpose: To study the adaptation of contact lens in a sample of 133 eyes with irregular astigmatism.

Methods: A retrospective study was made in 133 eyes with irregular astigmatism. The selection criterion was to obtain a sample population with irregular astigmatism that was unlikely to be corrected with spectacles or conventional contact lens. A complete ophthalmologic exploration which included a topography with the Eye-Sys 2000 corneal topographer was made. The variables analyzed in the study were: refraction, visual acuity before and after the correction, cause of the astigmatism and contact lens used.

Results: An equal number of women and men were enrolled in the study. The right eye was studied in 52% of the cases, and the left eye in 46%. Both eyes were affected in 67% of the subjects. The reason for the astigmatism was keratoconus in 110 eyes (78.2%), and there were 4 corneal injuries, 9 ocular infections, and 6 idiopathic astigmatisms. Among the contact lens used in the study: in 103 eyes a hybrid lens (Softperm®) was adapted, in 20 eyes a piggy-back system, in 5 eyes a thick hydrophilic lens (Queratoss®), in 4 eyes a hydrophilic contact lens and in 3 cases a rigid gas permeable contact lens. The average visual acuity before the adaptation was 0.28 (SD

RESUMEN

Objetivos: Estudiar la adaptación de lentes de contacto en 133 ojos con astigmatismos irregulares.

Material y métodos: Se realizó un estudio retrospectivo en 133 ojos con astigmatismos irregulares. El criterio de inclusión fue tener un astigmatismo irregular imposible de corregir con gafas o con lentes de contacto de diseño estándar. Se efectuó una exploración oftalmológica completa, incluyendo topografía con Eye-Sys 2000. Las variables que se tuvieron en cuenta fueron: refracción, agudeza visual antes y después de la adaptación, etiología y tipo de lente de contacto.

Resultados: De la muestra 50% fueron mujeres y 50% hombres, 52% de los ojos fueron derechos y 46% izquierdos y con afectación bilateral un 67%. El 78,2% (110 casos) de los ojos tratados correspondieron a queratoconos, cuatro traumatismos corneales, nueve infecciones corneales y seis astigmatismos idiopáticos.

De las 133 lentes de contacto que se adaptaron 103 fueron lentes híbridas (Softperm®), 20 sistemas piggy-back, cinco hidrofílicas gruesas (Queratoss®), cuatro hidrofílicas y tres rígidas gas permeables. La agudeza visual (AV) previa media fue de 0.28 (DE 0.24) (rango 0.1-0.8). Después de la adaptación de la lente de contacto la agudeza visual fue
0.24) (range 0.1-0.8). After the use of the lens the average visual acuity was 0.81 (SD 0.23) (range 0.1-1). Statistically significant differences between the visual acuity before and after treatment were found, with an improvement of 0.53 (SD 0.28) obtained.

**Conclusion:** Only with experience using a large variety of non-conventional contact lens can a specialist contact lens ophthalmologist achieve a good result (Arch Soc Esp Oftalmol 2007; 82: 747-752).

**Key words:** Irregular astigmatism, keratoconus, contact lens, hybrid lens, piggy-back system.

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**INTRODUCTION**

Irregular astigmatism is a cause of vision loss. Correction with contact lenses is the treatment of choice and the key to visual success in most cases (1-3). The challenge is to maintain the patient with an acceptable tolerance together with adequate visual acuity in corneas in continuous change (4). This study assessed the characteristics of patients with irregular astigmatism and the different etiologies thereof. It also aims to demonstrate the possibility of achieving acceptable visual acuity with the adaptation of contact lenses. To this end, it is considered necessary to utilize a larger variety of models of contact lenses and to be fully knowledgeable on adaptation systems.

**SUBJECTS, MATERIAL AND METHODS**

**Population of patients**

A retrospective study was carried out on 133 eyes in 79 patients with irregular astigmatism of all the etiologies listed in our ophthalmological clinic. The inclusion criterion accepted all irregular astigmatisms unable to achieve good visual acuity (VA) with spectacles or standard design contact lenses.

**Data collected**

The following parameters were quantified: eye (right/left), laterality (unilateral/bilateral), sex, irregular astigmatism etiology, visual acuity (AV) pre- and post-adaptation, refraction pre- and post-adaptation. The types of contact lenses utilized were:

- **Group 1:** combined lens [Softperm® (Ciba vision)].
- **Group 2:** piggy-back system [Proclear® (Cooper vision)-Polycon II® (Lenticon), Proclear® -Permi-flex® (Eurolent s.l), Standard® (Ciba vision)-Permi-flex® (Eurolent s.l), Durasoft 3 color blends® (Ciba vision)-Polyfocal oxicon 100® (Lenticon), Standard® (Ciba vision)-Wolk A90® (Eurolent), Standard® (Ciba vision)-Acrileans I® (Lentiflex), Standard® (Ciba vision)-Acrileans II tórica® (Lentiflex), Softmate B® (Ciba vision)-Permi-flex color® (Eurolent s.l), Softmate B® (Ciba vision)-Acrileans II® (Lentiflex)].
- **Group 3:** thick hydrophylic lens [Queratosoft 38® (Lenticon)].
- **Group 4:** hydrophlic lens [Zero 6 thoric® (Cooper vision), Zero 6 spherical® (Cooper vision)].
- **Group 5:** permeable gas rigid lens (RGP) [Keratocon policon® (Lenticon)].

All the contact lens combinations available in our practice were tested until an adequate adaptation was obtained for each patient. The combined lens comprised a central segment made with pentasilcon and the peripheral ring of hydrophilic material with 20% water. The diameter of the central ring was 8 mm, with the total diameter being of 14.3 mm and the optic area of 7 mm. The thick hydrophlic lens has a 3-curve design, increased central width (between 0.4 and 0.6 mm) and low-hydrophylic materials (glycerol in this case) which can be a very useful alternative with hydrophilic contact lenses. The piggyback or sandwich system is the adaptation of a hydrophilic lens with an RGP lens on top.

The causes of irregular astigmatism were divided in five groups: keratocone, corneal traumatism, leucoma due to corneal infection, keratoplasty and idiopathic irregular astigmatism. The latter term is
taken to mean the kind of astigmatism which does not have a characteristic keratocone topographic pattern and which does not evolve in time. The refraction was obtained by means of an objective automatic refractometer, with the graduation fine tuned by subjective analysis with the E Snellen optotypes in both situations, pre-adaptation and post-adaptation of the contact lens. For a better comparison between refractions the spherical equivalent (ES) was calculated (equal to the spherical power of the lens plus half the astigmatism).

Procedure

At the beginning of the adaptation and one month after its completion a full ophthalmological assessment was made. Said assessment included a topography with the Eye-Sys 2000 (EyeSys 2000 Corneal Analysis system. Eyesys Technologies, Inc. Houston. Texas. USA) topograph. Together with the keratometer, this instrument was very useful to diagnose and classify irregular astigmatism but not for selecting the type of contact lens.

After classifying the irregular astigmatism, the adaptation of a combined lens was initiated and, if tolerance problems arose in spite of a good adjustment, a thick hydrophilic lens was tested. If adequate parameters were not manufactured and the residual astigmatism exceeded one dioptre, the piggyback system was utilized. RGP lenses were used only as a last resort or when the patient’s eye blinking was not adequate to activate the previous procedures. The use of the hydrophilic lens was kept for small irregular astigmatisms.

The testing time for each design and the final adaptation time were highly variable because in some cases models had to be discarded at the beginning and in others after the patient had been using the lenses regularly for some time. An adequate adaptation was assessed as correct centering, movement and when necessary a good fluorescein pattern.

The adaptation was considered a success with the verification of tolerance during a working day (at least eight hours) for one month.

RESULTS

Of the 133 eyes with irregular astigmatism the following data were obtained. 50% of the eyes belonged to men and the other half to women. 48% were right eyes and 52% left eyes. 33% of patients had both eyes affected and in 67% the pathology was unilateral. Figure one shows that the age group most affected was 40-49 years (46 cases) followed by the group of 30-39 years (36 cases), and 20-29 years with 31 cases. The mean age of diagnostic of irregular astigmatism in this study was of 34.9 SD 10.7 years and the minimum age of 2 years.

Figure two shows the different etiologies. The most frequent cause of irregular astigmatism was keratocone with 110 eyes followed by 9 cases of astigmatism caused by leucoma due to corneal infection, six idiopathic irregular astigmatisms, four post-keratoplasties and four corneal traumatisms.

When quantifying the pre-adaptation refraction of eyes with irregular astigmatism it was seen that in 60.9% it was impossible to perform a refraction, which accordingly was made only in 39.1% of eyes. In this group, it was seen that the most frequent
refraction defect measured as SE was that comprised between 0 and -8 dioptres (Dp) (fig. 3) with a mean preadaptation SE of -5 (SD 4.3) Dp. However, after the adaptation of the contact lens in 133 eyes it was possible to perform adequate refractions for all, identifying that the most frequent refraction defect was in the group of -2 a -4 Dp (fig. 3) with a mean post adaptation SE of -2.5 (SD 4.5) Dp.

As can be seen in figure 4, the most utilized contact lens was the combined lens (103 eyes) followed by the piggyback system (17 eyes), the thick hydrophilic lens (5 eyes), the hydrophilic lens (4 eyes) and RPG in 4 eyes.

The best pre-adaptation corrected visual (VA) was of 0.21 SD 0.24 while the mean post adaptation VA was of 0.81 (SD 0.23), with a mean visual improvement of 0.53 SD 0.28.

**DISCUSSION**

The authors are in agreement with Maguen (5) and Yeung (3) who pointed out that the most frequent etiology of irregular astigmatism is keratocone. In the initial stages of keratocone, it is likely that the visual acuity can be improved with spectacles or spherical or thoric hydrophilic contact lenses. But when the disease progresses, the cornea becomes more irregular and common optical corrections fail to improve visual acuity. At this time, it is necessary to consider the adaptation of other types of contact lenses.

And though this study has not obtained data of patients operated with refractive surgery, we know that the increased use of this technique has entailed the discovery in the preop stage of previously unknown keratocones, in addition to the iatrogenic effect which causes irregular astigmatism.

It was possible in this study to adapt a contact lens for each of the 133 patients to achieve improvements in visual acuity together with adequate tolerance. No serious complications arose during the adaptation period. It must be noted that this will not always be the case because, depending on the corneal deformity, sometimes it is impossible to adapt a lens. In these cases, the possibility of surgery should be considered.

The most successful contact lens as regards adaptation (best VA -comfort) was the combined contact lens followed by the piggyback system. According to Yeung, Maguen, O’Donnell (3,5,6), the contact lens which most frequently adapts to irregular corneae is the RGP. In our view, RGP is a type of lens which functions properly but in some cases produces discomfort and, in advanced irregular astigmatism cases, adaptation becomes impossible. Due to these inconveniences, throughout our experience we had to seek a substitute for this type of lens in order to resolve the visual problems of our patients. Thus, both the combined and the piggyback lenses create greater balance in the movement and comfort for patients because the cornea is covered by the hydrophilic lens. In addition, the central area of the-
se lenses includes a rigid lens to optimize vision.

As in the study of Lim (5), it was found that the diagnostic age of irregular astigmatism was in the age group of 30-49 years. It must be said that this is the age group in which the patient is diagnosed, but we must not confuse the time of diagnosis with the time of onset of the disease, in the case that the cause of irregular astigmatism is keratocone or idiopathic which, as we know, is difficult to determine. The age of beginning and diagnostic for the other causes of irregular astigmatism matches the findings of said study.

Correcting an irregular astigmatism is a challenge for the ophthalmologist. In most cases, spectacles with adequate correction failed to improve the VA, leaving contact lenses as the sole option for treatment in lieu of surgery. For this reason, all the options for contact lenses must be explored for each eye with irregular astigmatism. Only by testing a large variety of lens types good visual results will be achieved for these complex patients with whom the ophthalmologist faces the challenge of maintaining good tolerance together with adequate VA in a changing cornea (4).

As conclusion of our study, it can be said that contact lenses continue to play a relevant role in the treatment of irregular astigmatism (1,2,7,9,10) because they improve the VA of these patients and exhibit lower risks than surgical procedures such as corneal rings and keratoplasty.

We encourage contact lens experts to treat irregular astigmatism. However, a word of caution: it is necessary to have a large range of contact lens models (11) and avoid the preferential use of any single type, as well as exercising patience and perseverance to achieve adequate functional results.

Unfortunately we are unable to provide magic recipes for adapting contact lenses in this type of cornea. We cannot even attempt to correlate the refractive preadaptation measures with the type of finally adapted lens because, in most occasions, the preadaptation SE is impossible to determine (8). After many years, we continue to resort to the trial and error method.

REFERENCES