ORIGINAL ARTICLE

Custom-Q Versus Wavefront Optimized Photorefractive Keratectomy for Myopia With or Without Astigmatism Correction

Queratectomia Fotorrrefrativa Custom-Q versus Wavefront Optimized para Miopia com ou sem Astigmatismo

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ABSTRACT

INTRODUCTION: To compare the results between photorefractive keratectomy (PRK) with Custom-Q or with Wavefront-optimized (WFO) profiles in terms of asphericity and spherical aberrations, 6 months post-operative.

METHODS: Fifty-nine eyes (43 patients) were enrolled on this retrospective case series, including patients with myopia and/or astigmatism, submitted to refractive surgery with PRK (Allegretto WAVE Eye-Q Excimer Laser System, Alcon), in a Custom-Q ablation (38 eyes) or Wavefront-optimized procedure (21 eyes). We included patients with a minimum follow-up of 6 months; age over 21 years; stable refractive error for 2 years; spherical equivalent (SE) inferior to 5.50 diopters (D); percentage of altered tissue under 40% and expected final corneal curvature above 35 D. Eyes with other ophthalmological pathologies were excluded. Baseline and post-operative asphericity and optical aberrations were evaluated with Pentacam (Oculus Optikgeräte, Wetzlar, Germany).

RESULTS: The demographic and preoperative refractive data was similar between groups (all $p \geq 0.05$). Post-operative spherical equivalent in the Custom-Q and Wavefront-optimized groups was within 0.50D in 100% and 78.90% of eyes, respectively and within 0.25D in 97.06% and 73.70% of eyes, respectively. Variation of Q-value was 0.62±0.34. (range -0.07-1.24) for Custom Q group, and 0.65±0.39 (range -0.05-1.40) in the Wavefront-optimized group ($p=0.82$). In a multivariate linear regression model, variation of Q-value was not influenced by the ablation profile (B=0.04, $p=0.49$, 95%CI [-0.08,0.17]). SE was a strong predictor (B=-0.30, $p<0.01$, 95%CI [-0.39,-0.21]). There was a significant increase in RMS higher-order aberrations ($p<0.01$ for both groups) and no difference between groups ($p=0.53$).

DISCUSSION AND CONCLUSION: In our sample, Custom-Q ablation was not significantly different from Wavefront optimized ablation regarding post-operative asphericity. Although the increase in higher-order aberrations, both techniques were effective and safe for myopic and/or astigmatic correction up to -5.50D SE.

KEYWORDS: Astigmatism; Corneal Wavefront Aberration/physiopathology; Myopia; Photorefractive Keratectomy.

RESUMO

INTRODUÇÃO: Comparar os resultados entre queratectomia fotorefrativa (PRK) com perfis *Custom-Q* ou *Wavefront-optimized* (WFO) relativamente à asfericidade e aberrações esféricas, 6 meses após a cirurgia.

MÉTODOS: Neste estudo retrospetivo foram incluídos 59 olhos (43 doentes) com miopia e/ou astigmatismo submetidos a cirurgia refrativa com PRK (*Allegretto WAVE Eye-Q Excimer Laser System, Alcon*). Trinta e oito olhos foram tratados com o procedimento *Custom-Q* e 21 olhos com o procedimento *Wavefront-optimized*. Foram incluídos doentes com um seguimento mínimo de 6 meses; idade acima de 21 anos; erro refrativo estável por 2 anos; equivalente esférico inferior a 5,50 dioptrias (D); percentagem de tecido alterado inferior a 40% e curvatura final da córnea esperada acima de 35 dioptrias. Foram excluídos olhos com outras patologias oftalmológicas. A asfericidade basal e pós-operatória e as aberrações ópticas foram avaliadas com *Pentacam* (*Oculus Optikgeräte, Wetzlar, Germany*).

RESULTADOS: Os dois grupos eram semelhantes quanto aos dados demográficos e dados refrativos pré-operatórios ($p \geq 0{,}05$). O equivalente esférico no pós-operatório foi inferior a 0,50D em 100% dos olhos no grupo *Custom-Q* e 78,90% dos olhos no grupo *Wavefront-optimized*, e foi inferior a 0,25D em 97,06% e 73,70% dos olhos, respetivamente. A variação do valor Q foi de 0,62±0,34 (intervalo -0,07-1,24) no grupo *Custom-Q* e 0,65±0,39 (intervalo -0,05-1,40) no grupo Wavefront-optimized (p=0,82). A variação do valor Q não foi influenciada pelo perfil de ablação (B=0,04, p=0,49, 95%CI [-0,08,0,17]) e o equivalente esférico foi um forte preditor (B=-0,30, p<0,01, 95%CI[-0,39,-0,21]). Verificou-se uma diferença significativa nas aberrações de alta ordem em cada grupo (p<0,01) apesar de não se ter observado uma diferença significativa entre os grupos (p=0,53).

DISCUSSÃO E CONCLUSÃO: Na nossa amostra, a ablação com o perfil *Custom-Q* não foi significativamente diferente do perfil *Wavefront-optimized* relativamente à asfericidade pós-operatória. Apesar do aumento nas aberrações de alta ordem, ambas as técnicas foram eficazes e seguras para a correção de miopia e/ou astigmatismo até -5,50D.

PALAVRAS-CHAVE: Aberrações de Frente de Onda da Córnea/fisiopatologia; Astigmatismo; Miopia; Queratectomia Fotorefrativa.

INTRODUCTION

Myopia is a crescent global public health problem, corresponding to the most frequent type of refractive error[1,2] and representing 15% to 49% of prevalence worldwide.[3] It is believed that environmental factors play a crucial role in myopia development although its exact etiology remains unclear.[4] Myopia may lead to several consequences regarding the quality of life by interfering in vision-related tasks and leading to the development of medical complications in high myopia cases, such as myopic macular degeneration, choroidal neovascularisation, cataract, glaucoma and retinal detachment.[1,2]

The shape of a refractive surface can be classified as spherical, prolate aspheric and oblate aspheric. The cornea is a refractive media that is not physiologically spherical.[5-7] It is naturally prolate aspheric, being steeper in the center and flatter in the periphery.[8,9] The way the lightning rays focuses behind a refractive medium is influenced by its asphericity and a prolate surface allows a single point of focus, improving the quality and sharpness of vision.[8]

The asphericity can be expressed by the Q-value.[5,6] Zero describes a spherical surface, positive Q-value describes an oblate surface and a negative Q-value describes a prolate surface.[8]

The eye has two main optical elements, cornea and lens. These structures are responsible for natural aberration balance, reducing the amount of spherical aberration.[10] Spherical aberration is considered to be the most relevant higher-order aberration regarding the degradation of the quality of vision[8] and it is lower for negative Q-values. In this way, the quality and sharpness of vision increase with the decrease of the Q-value and spherical aberration,[9] until a target Q-value of -0.40.[5] On the contrary, in oblate surfaces, the Q-value and the spherical aberration are positive and there is loss of quality of vision, namely decreased contrast sensitivity and reduced low contrast vision.[7,8]

The physiologic Q-value in an untreated cornea ranges between 0.50 and -0.88, with an average value of -0.25,[11] and it tends to stay constant during life, being modified due to corneal surgery.[8,9]

Myopia can be corrected through excimer laser, which reduces dependence on eyeglasses or contact lenses, with high predictability outcomes and excellent satisfaction rates[3,12] These refractive surgery procedures are one of the possible ways of modifying the natural shape of the cornea because they are based on the change in corneal thickness and/or curvature.[5]

There are several techniques for the correction of refractive errors such as myopia and astigmatism. The first procedure approved by the U.S. Food and Drug Administration (FDA) was photorefractive keratectomy (PRK), in 1996. In 1998, laser-assisted in situ keratomileusis (LASIK) replaced PRK and has been the most predominant refractive surgery worldwide since the 1990s. After this, other variants have appeared, such as femtosecond laser (FS-LASIK), laser-assisted sub epithelial keratectomy (LASEK), femtosecond lenticule extraction (FLEX) and small incision lenticule extraction (SMILE).[3] The most successful ones are the ablative procedures using the excimer laser.[5]

With standard ablation profiles, the central cornea is flattened[7] and the natural prolate shape is converted into an oblate shape.[7,13,14] This increases the Q-value and the spherical aberration, with consequences regarding the quality of vision[7,10,14] especially in low brightness and low contrast conditions, inducing glare and haloes.[5,6,8,9,11] This led to the development of new aspheric algorithms,[5,6,9-11,13,15] such as wavefront-optimized techniques and Custom-Q, which improved visual outcomes.

Customized treatments such as the Custom-Q profile aim to reduce the spherical aberration through an additional correction in the midperiphery of the cornea.[5,6,11] This procedure is based on preoperative corneal topography and it has the potential to replace standard techniques for corrections of myopic astigmatism.[5,6] It allows the definition of the desired asphericity target, unlike the wavefront-optimized technique, in which it is not adjustable.[6,11,16] Some studies comparing these two procedures found that they seem to be clinically equivalent, although there is less impairment in the corneal asphericity in patients treated with Custom-Q procedure.[6,16]

The objectives of this study are to compare the results between photorefractive keratectomy with Custom-Q or with Wavefront-optimized profiles in terms of asphericity and spherical aberrations, 6 months post-operative. Furthermore, this study aims to evaluate the difference and relation between the Q-value programmed in the group treated with Custom-Q ablation profile and the asphericity obtained at 6 months after the surgery, and also to evaluate if this difference has any association with the preoperative refractive error.

METHODS

STUDY GROUP

This retrospective study was performed at a tertiary referral center (Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal). It included patients with age over 21 years, submitted to refractive surgery for correction of myopia and/or myopic astigmatism at least 6 months before, and with stable refractive error for 2 years, under 5.50 diopters (D), leading to a percentage of altered tissue under 40% and not causing excessive corneal flattening (expected final corneal curvature above 35 D). Exclusion criteria were the presence of other corneal or systemic disease (as systemic connective tissue disorders); intra or post-operative complications, such as infection or severe dry eye that prevents the correct acquisition of corneal topography; previous refractive surgery; non attendance to appointments or examinations during the stipulated periods; pregnancy.

EXAMINATIONS

All patients were submitted to a complete preoperative assessment with medical history and ophthalmic examination. This consisted in the assessment of refraction with duochromatic test, uncorrected visual acuity (UCVA), best spectacle-corrected visual acuity (BSCVA), intraocular pressure and tear film evaluation, biomicroscopy, fundoscopy, motor eye dominance (especially in mini-monovision cases), aberrometry, Pentacam (Oculus Optikgeräte, Wetzlar, Germany) and Allegro Topolyzer topography.

Patients were then seen post-operatively between the 3rd and 6th day. This consisted in a summary assessment to attest the re-epithelization.

At the 3rd and 6th months after surgery, the ophthalmologic examination was repeated as detailed above.

Q-VALUE ANALYSIS

Preoperative and post-operative Q-values were obtained with a corneal tomography system, Pentacam.

SURGICAL TECHNIQUE

All patients were submitted to refractive surgery with excimer laser, using PRK (Allegretto WAVE Eye-Q Excimer Laser System, Alcon). The target asphericity was programmed for each patient in the Custom-Q ablation group, corresponding to the Q value in the 6 mm zone of the Pentacam Holladay Report. In patients with age over 35 years, the target value was more negative by 0.10. Initially, a central area of the cornea epithelium is removed with a blade. Then, an excimer laser is used to precisely reshape the surface of the cornea. Mitomycin C was used for 15 seconds whenever the ablation depth was higher than 50 μm.

DATA COLLECTION

The clinical information related with the demographic data, type of surgical procedure, visual acuity, sphere, cylinder and target asphericity were obtained in the clinical file of each patient. The pre and post-operative asphericity and spherical aberration were obtained in the computer program, Ophtal-Suite, Blueworks, Coimbra, Portugal.

This data was collected with the authorization of the CHUC Ethical Commission, and the confidentially rules of the service were respected. After the collection, the information was submitted to an anonymization process.

DATA ANALYSIS

The statistical analysis was done with STATA v16.6 program (Software for Statistics and Data Science). The variables normality was assessed with the Shapiro-Wilk test and with the Kolmogorov-Smirnov test. In this way, using the Paired samples T-Test, the difference between post-operative and target Q-value was analyzed, as well as the difference between post and preoperative asphericity and other refractive parameters. The change in higher-order aberrations was analyzed with the non-parametric Wilcoxon test.

The Pearson Correlation was used to assess the association between preoperative refractive error and the change in corneal asphericity after surgery. The ANOVA One Way test was used to evaluate the difference of the achieved and planned asphericity regarding the preoperative refractive error.

To compare the differences between the change in asphericity in Custom-Q ablation group and the wavefront-optimized group we used a T-Test for independent samples and to compare the post-operative higher-order aberrations between these groups a Mann-Whitney test.

A p value less than 0.05 was considered statistically significant.

RESULTS

Forty-three patients and 59 eyes with myopia and/or astigmatism were enrolled in our study. Of these, 38 eyes were treated with Custom-Q ablation profile between 2018 and 2019 with mean age 35.55 ± 6.64 (range 21-49), and 21 were treated with wavefront-optimized profile between 2016 and 2019 with mean age 35.67 ± 8.25 (range 20-49) (p=0.47). The demographic and preoperative refractive data are listed in Table 1, showing that these two groups are similar considering all the parameters ($p \geq 0.05$), including preoperative spherical equivalent (-3.45 ± 1.21 (range -5.50 to -1) in Custom-Q group *vs* -3.82 ± 0.98 (range -5.38. to -1.38) in wavefront group (p=0.23)).

VISUAL ACUITY

The post-operative refractive data is listed in Table 2. At 6 months post-op, no eye in either group lost lines of BSC-

Table 1. Demographic and preoperative refractive data

	Custom-Q ablation group (N=38)				Wavefront-Optimized group (N=21)			
Parameter	**Mean ± SD**	**Min**	**Max**		**Mean ± SD**	**Min**	**Max**	***p* value**
Age (years)	35.55 ± 6.64	21	49		35.67 ± 8.25	20	49	0.47
Asphericity (Q-value)	-0.17 ± 0.09	-0.39	0.01		-0.14 ± 0.09	-0.32	0.01	0.07
RMS HOA	0.41 ± 0.11	0.21	0.89		0.41 ± 0.10	0.22	0.73	0.89
Spherical Equivalent	-3.45 ± 1.21	-5.50	-1		-3.82 ± 0.98	-5.38	-1.38	0.23
Pachy	554.29 ± 26.65	512	633		555.15 ± 36.57	502	634	0.92
K1	43.04 ± 1.42	38.59	47.4		42.72 ± 1.46	38.59	44.94	0.21
K2	44.09 ± 1.35	39.57	47.8		43.75 ± 1.47	39.57	46.03	0.15
KMax	44.77 ± 1.35	42.5	49.4		44.74 ± 1.63	41.5	49.4	0.89

SD – standard deviation; Min – minimum; Max – maximum; RMS – root mean square; HOA – higher order aberration; Pachy – pachymetry.

Table 2. Post-operative refractive data

	Custom-Q ablation group (N=38)				Wavefront-Optimized group (N=21)			
Parameter	**Mean ± SD**	**Min**	**Max**		**Mean ± SD**	**Min**	**Max**	***p* value**
Asphericity (Q-value)	0.47 ± 0.36	-0.29	1.2		0.51 ± 0.39	-0.29	1.20	0.46
Change in Asphericity	0.63 ± 0.36	-0.07	1.4		0.65 ± 0.39	-0.05	1.40	0.81
RMS HOA	0.64 ± 0.18	0.35	1.37		0.67 ± 0.18	0.31	1.15	0.53
Spherical Equivalent	-0.02 ± 0.12	-0.5	0.25		-0.8 ± 0.33	-0.8	0.75	0.31
Pachy	489.61 ± 33.41	413	557		488.33 ± 33.03	414	551	0.89
K1	39.99 ± 1.4	37.33	43.09		39.43 ± 1.57	36.70	42.43	0.17
K2	40.60 ± 1.56	37.53	43.81		40.03 ± 1.69	37.24	42.92	0.19
KMax	44.20 ± 1.36	41.60	47.5		44.20 ± 1.63	41.50	49.40	0.99
LogMAR BSCVA	-0.02 ± 0.06	-0.10	0.10		-0.02 ± 0.04	-0.10	0	0.75

SD – standard deviation; Min – minimum; Max – maximum; RMS – root mean square; HOA – higher order aberration; BSCVA – best spectacle-corrected visual acuity; Change in asphericity – difference between post and preoperative Q-value; Pachy – pachymetry.

VA. The post-operative mean logMAR BSCVA was -0.02 ± 0.05 (range -0.10-0.10) in the Custom-Q ablation group, and -0.02 ± 0.05 (range -0.10-0) in the WFO group (p=0.75), and no patient had a decrease in post-operative visual acuity. Post-operative spherical equivalent in Custom-Q and WFO groups was within 0.50D in 100% and 78.90% of the eyes (p=0.01), respectively, and within 0.25D in 97.06% and 73.70% of the eyes (p=0.02), respectively. This represents a tendency to better results in the Custom-Q group.

Furthermore, we did not register any complications with clinical significance, namely haze, moderate or severe dry eye, or dysphotopsia, in either group.

ASPHERICITY (Q-VALUE)

Variation of Q-value was 0.62 ± 0.34 (range -0.07-1.24) for Custom-Q group, and 0.65 ± 0.39 (range -0.05-1.40) for WFO group, p=0.81 (Table 2). Target Q-value (mean -0.27 ± 0.11) was not related with post-operative Q-value (mean 0.44 ± 0.34, p<0,01), with higher post-operative values in all eyes (Table 3). In fact, only 36% of the eyes obtained a Q-value proximity to the target value under 0.50 (Fig. 1) and we achieved a lower disparity between target and post-operative Q-value in patients with lower preoperative SE (Fig. 2).

Table 3. Target and post-operative Q-value

	Custom-Q ablation group (N=38)		
Parameter	**Mean ± SD**	***p* value**	**Pearson Correlation (*p* value; r-Correlation coeficient)**
Target Q-value	-0.27 ± 0.11	<0.01	p =0.42; r =0.14
Post-operative Q-value	0.44 ± 0.34		

SD – standard deviation.

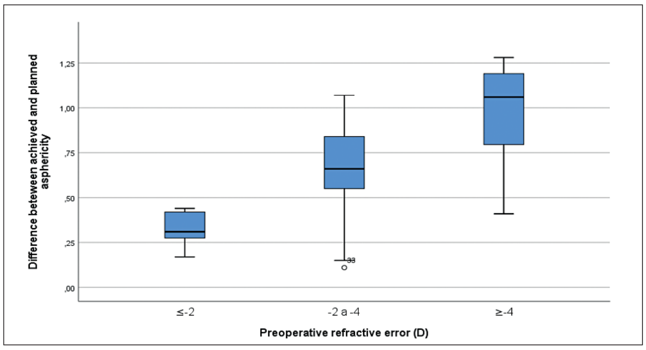

Figure 1. Percentage of eyes in the Custom-Q ablation group showing achieved Q-target proximity.

In a multivariate linear regression model, variation of Q-value following PRK was not influenced by technique (B=0.04, p=0.49, 95%CI [-0.08,0.17]), after controlling for SE which was a strong predictor (B=-0.30, p<0.01, 95%CI[-0.39,-0.21]), Fig. 3.

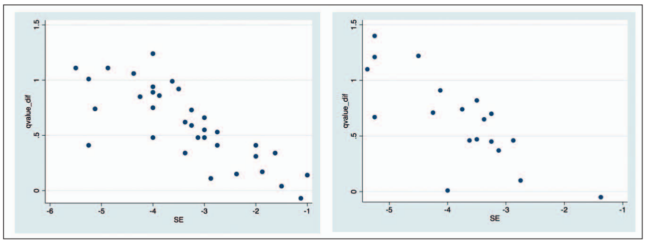

Figura 2. Difference between achieved and planned asphericity regarding the preoperative error (ANOVA One Way: p<0.05; Tukey: p<0.05).

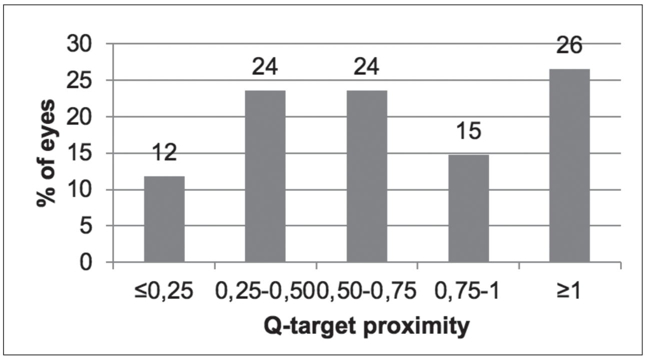

Figure 3. Relationship between preoperative spherical equivalent (SE) and the change in corneal asphericity (Q-value_dif) after surgery in Custom-Q group (left graph) and wavefront-optimized group (right graph).

RMS HIGHER-ORDER ABERRATIONS

Concerning higher-order aberrations, there was a statistically significant difference between pre and post-operative RMS HOA values (Custom-Q group: p<0.01, Table 4; WFO group: p<0.01, Table 4). However, there was no statistically significant difference between groups (p=0.53, Table 2).

DISCUSSION

The Custom-Q ablation profile allows the establishment of a target asphericity value. This is relevant in clinical practice since it allows customizing the value of asphericity for each patient and adapting it to their actual need.

Because of the impact that asphericity may have on vision quality,[5-9,14] the way it changes after refractive surgery has been the subject of different studies over several years. This research has been contributing to an improvement in excimer laser platforms, with advances in ablation profiles, leading to better outcomes.[4] A previous study suggested that a more natural corneal ablation could be obtained by increasing tissue removal in the periphery.[9] Essentially, this is one of the techniques used in the Custom-Q profile.[5,6]

Regarding the Q-target proximity, we observed that the postoperative Q-value was higher than the target Q-value programmed, with no association between these parameters. In 2008, Aleksandar Stojanovic *et al*[16] showed similar results in this area, with an absence of agreement between planned and achieved Q-value. In the same way, but with

Table 4. **Difference between post-operative and preoperative refractive parameters**

	Custom-Q ablation group (N=38)			
Parameter	**Preoperative Mean ± SD**	**Post-operative Mean ± SD**	**Post-operative and Preoperative mean difference**	***p* value**
Asphericity (Q-value)	-0.17 ± 0.09	0.47 ± 0.36	0.63 ± 0.36	<0.01
RMS HOA	0.40 ± 0.09	0.62 ± 0.16	0.22 ± 0.19	<0.01
Pachy	554.29 ± 26.64	489.61 ± 33.41	-64.68 ± 21.36	<0.01
K1	43.04 ± 1.41	39.79 ± 1.48	-3.29 ± 1.46	<0.01
K2	44.09 ± 1.34	40.40 ± 1.61	-3.73 ± 1.35	<0.01
KMax	44.77 ± 1.35	44.20 ± 1.45	-0.59 ± 0.92	<0.01
	Wavefront-optimized ablation group (N=21)			
Parameter	**Preoperative Mean ± SD**	**Post-operative Mean ± SD**	**Post-operative and Preoperative mean difference**	***p* value**
Asphericity (Q-value)	-0.14 ± 0.09	0.51 ± 0.39	0.65 ± 0.38	<0.01
RMS HOA	0.41 ± 0.11	0.64 ± 0.18	0.23 ± 0.12	<0.01
Pachy	555.25 ± 36.57	488.33 ± 33.03	-66.83 ± 23.00	<0.01
K1	42.72 ± 1.46	39.43 ± 1.57	-3.42 ± 1.54	<0.01
K2	43.75 ± 1.47	40.02 ± 1.69	-3.86 ± 1.49	<0.01
KMax	44.74 ± 1.48	44.20 ± 1.63	-0.58 ± 0.91	0.02

SD – standard deviation; Min – minimum; Max – maximum; RMS – root mean square; HOA – higher order aberration; Pachy - pachymetry.

hyperopic patients, in 2016, Courtin *et al*[17] concluded that the relationship between achieved and attempted change in corneal asphericity was lower than expected.

As expected in myopic ablation procedures, we verified a strong association between higher achieved asphericity and higher preoperative spherical equivalent. Other previous studies with PRK and LASIK had similar results, with a Q-value increase after surgery, especially in patients with higher corrections.[5,6,9,11,14,16] Koller *et al* showed a considerably smaller shift for corrections up to -5 D.[5]

Regarding the comparison with the Wavefront-optimized ablation group there were no significant differences in asphericity change, although the postoperative Q-value mean was lower in the Custom-Q ablation group. However, other studies showed statistically significant differences between Custom-Q and Wavefront-optimized postoperative asphericity. Aleksandar Stojanovic *et al*[16] observed a less oblate cornea in the Custom-Q group (p=0,049) and Tawfik *et al*[6] reported a more significant difference (p=0,02), with less asphericity impairment in the Custom-Q group, in patients treated with LASIK. In 2009, Goreishi *et al*[11] compared Custom-Q profiles with Wavefront-guided procedures and also concluded that Custom-Q treated eyes were less oblate, although they did not find a significant difference between both groups. This may be due to the amount of Q-value correction attempted in each study. It is possible that we have to program a more negative Q-value to obtain the desired target value.

Besides the change observed in corneal asphericity in our study, we found a statistically significant difference in relation to RMS higher-order aberrations in each group and no relevant difference comparing the two groups. Previous studies showed similar results with PRK, using several procedures[15,18-20,] while Aleksandar Stojanovic *et al*[16] and Ryan *et al*[21] observed no significant change in RMS higher-order aberrations and this is an important aspect since higher-order aberrations impact on quality of vision.[8,14]

According to some mathematical models, the asphericity in the treated zone should not significantly change due to the removal of a sphere from the corneal surface.[9] Some explanations have been proposed to clarify this change. On the one hand, the laser does not affect the sloping cornea in a perpendicular way, and peripheral cornea is not flattened enough.[9] Moreover, there is also the influence of the wound healing with epithelial remodeling and biomechanical response to the surgical treatment, which change the desired aspheric shape of the cornea and is responsible for changes in corneal topography over time,[5,7,9-11,17,19,22,23] even with a perfect ablation.[10]

Besides this, considering the improvement of the near vision without excessively compromising distance vision, the required change in corneal asphericity and the subsequent spherical aberration variation are not completely defined.[17] Gatinel *et al*[7] showed, with a theoretical model, that to achieve a more prolate cornea, the maximal depth of ablation was increased. And, although reducing the diameter of treatment zone could increase negative asphericity without increasing the risk of ectasia for high magnitudes of treatment, reducing the treatment diameter could induce undesirable optical edge effects and may obliterate the positive effect of restoring the prolate shape of the central cornea.[7]

Regarding patients with high myopia (myopia above 6 D), there are some concerns due to the amount of tissue removed and the induction of higher order aberrations.[4,6] The difference between achieved and planned asphericity was higher and more unpredictable in patients with a pre-operative refractive error above -4D. This leads us to question whether it would be pertinent to establish an optimal refractive error limit for the application of this technique. It is believed that in patients with high myopia, the corneal biomechanical properties may be compromised, which can lead to unpredictable postoperative asphericity.[14,19]

Our study has some limitations, namely regarding the small number of patients and the short follow-up. It would be important to repeat this analysis with a larger sample, during a longer follow-up, in order to document changes over time. However, there are few studies comparing both PRK Custom-Q and Wavefront-optimized procedures, and the difference between planned and achieved Q-value.[16] This way, it is relevant that we are able to show both that ablation profiles are similar and that the postoperative corneal asphericity did not correspond to the programmed value. Since the Custom-Q technique is a procedure that widens the area of the laser action, it remains to be seen if its application will be positive and surgeons should not count on this profile to guarantee a lower increase in asphericity.

CONCLUSION

To conclude, the Custom-Q procedure is an innovative refractive surgery technique, that is not significantly different from Wavefront-optimized ablation regarding post-operative asphericity or higher-order aberrations. It combines the various advantages of the aspheric algorithms, with the possibility of programming the target asphericity of each patient.

In our study, the planned and the achieved asphericity were not coincident, which raises the need for further refinement in the laser profile and, possibly, a target Q-value nomogram, since the possibility of controlling the final asphericity is a useful complement.

RESPONSABILIDADES ÉTICAS

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.

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