ORIGINAL ARTICLE

Agreement of Vault Size Measurements between the Pentacam®, the Anterion® and the Spectralis®

Concordância nas Medições do *Vault* entre o Pentacam®, o Anterion® e o Spectralis®

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ABSTRACT

INTRODUCTION: Despite good refractive results, implantable collamer lens (ICL) implantation may lead to postoperative complications. One indicator of its safety is the vault size. Our purpose was to evaluate the agreement of vault size measurements between the Pentacam®, the Anterion® and the Spectralis®.

METHODS: Cross-sectional analysis of eyes previously submitted to ICL implantation. Vault size was evaluated with the Pentacam® HR, the Anterion® and the Spectralis® (anterior segment). Secondarily, the anterior chamber depth (ACD) was evaluated with the Pentacam® and the Anterion®. Images of the same patient were performed on the same day, by the same technician. Vault and ACD measurements were performed by two refractive surgeons. Images were randomly divided into three groups and each group was analyzed one week apart, by each observer, with images in a randomized order.

RESULTS: Fifty-five eyes (30 patients) were included. The intraclass correlation coefficient (ICC) for absolute agreement and consistency of vault measurements was good to excellent. The vault measurements obtained with Pentacam® were inferior to those obtained with the Anterion® and the Spectralis® ($p<0.001$). There were no differences between the Anterion® and the Spectralis® ($p>0.697$). The differences in the vault measurements between the Anterion® and the Pentacam® correlated positively with the increase of the vault size in the Anterion® ($p<0.001$) and the differences between the Spectralis® and the Pentacam® correlated positively with the increase of the vault size in the Spectralis® ($p<0.001$). The difference in vault measurements between the Anterion® and the Pentacam® correlated positively with the increase of the pupillary diameter in the Anterion® ($p<0.006$) and the difference between the Spectralis® and the Pentacam® correlated with the increase of the pupillary diameter in the Spectralis® ($p<0.014$). For ACD, the ICC for absolute agreement and for consistency between the Pentacam® and the Anterion® was good. Pentacam® provided inferior ACD sizes, compared to the Anterion® ($p<0.001$).

CONCLUSION: While the Anterion® and the Spectralis® may be used interchangeably, Pentacam® provided inferior values to those obtained with the other devices. The differences in vault size between devices are influenced by the vault size and the pupillary diameter measured with the Spectralis® and the Anterion®.

KEYWORDS: Anterior Chamber; Lens Implantation, Intraocular.

RESUMO

INTRODUÇÃO: Apesar dos bons resultados refrativos, o implante de *implantable collamer lens* (ICL) pode levar a complicações pós-operatórias. Um indicador da sua segurança é o tamanho do *vault*. O nosso objetivo foi avaliar a concordância nas medições do vault entre o Pentacam®, o Anterion® e o Spectralis®.

MÉTODOS: Análise transversal de olhos previamente submetidos a implante de ICL. O *vault* foi avaliado com o Pentacam® HR, o Anterion® e o Spectralis® (segmento anterior). Secundariamente, a profundidade da câmara anterior (ACD) foi avaliada com o Pentacam® e o Anterion®. As imagens do mesmo paciente foram realizadas no mesmo dia, pelo mesmo técnico. As medições do *vault* e da ACD foram realizadas por dois cirurgiões refrativos experientes. As imagens foram divididas aleatoriamente em três grupos e cada grupo foi analisado com uma semana de intervalo, por cada observador, com imagens em ordem aleatória.

RESULTADOS: Foram incluídos 55 olhos (30 doentes). O coeficiente de correlação intraclasse (ICC) para a concordância absoluta e a consistência das medições do *vault* foi bom a excelente. As medições do *vault* obtidas com Pentacam® foram inferiores às obtidas com o Anterion® e o Spectralis® (p<0,001). As diferenças nas medições do *vault* entre o Anterion® e o Pentacam® correlacionaram-se positivamente com o aumento do tamanho do *vault* no Anterion® (p<0,001) e as diferenças entre o Spectralis® e o Pentacam® correlacionaram-se positivamente com o aumento do tamanho do *vault* no Spectralis® (p<0,001). A diferença nas medições do *vault* entre o Anterion® e o Pentacam® correlacionou-se positivamente com o aumento do diâmetro pupilar no Anterion® (p<0,006) e a diferença entre o Spectralis® e o Pentacam® correlacionou-se com o aumento do diâmetro pupilar no Spectralis® (p<0,014). Para a ACD, o ICC para a concordância absoluta e para a consistência entre o Pentacam® e o Anterion® foi bom. O Pentacam® forneceu valores de ACD inferiores, em comparação com o Anterion® (p<0,001).

CONCLUSÃO: Embora o Anterion® e o Spectralis® possam ser utilizados indiscriminadamente, o Pentacam® forneceu valores inferiores aos obtidos com os outros dispositivos. As diferenças no tamanho do vault entre dispositivos são influenciadas pelo tamanho do *vault* e pelo diâmetro pupilar, medido com o Spectralis® e o Anterion®.

PALAVRAS-CHAVE: Câmara Anterior; Implante de Lente Intraocular.

INTRODUCTION

The implantable collamer lens (ICL) is a posterior chamber phakic intraocular lens used to correct refractive errors, including myopia, hyperopia or astigmatism.[1] These lenses are implanted posteriorly to the pupil and the haptics are positioned in the ciliary sulcus.[2]

ICL implantation leads to good visual and refractive results. Despite this, it has also been associated with postoperative complications.[3–7]

To guarantee good functional results, it is important that the implanted lens has minimal interference with the normal physiology of the eye.[2] Hence, overtime, these lenses underwent modifications designed to reduce the postoperative complications, such as the incorporation of a central port, the Aquaport, that allows an adequate aqueous flow and avoids the need to perform an iridotomy or iridectomy.[1]

One of the indicators of the ICL safety is the vault, which is the distance between the anterior crystalline lens surface and the posterior ICL surface. The ideal vault following ICL implantation should be of 250-750 μm.[8] Previous studies found an association between the vault size and the development of postoperative complications. While a vault superior to the recommended size could lead to angle closure, increase in the intraocular pressure and increased endothelial cell loss, a low vault could lead to cataract formation.[4,9,10] Even though the newer designs with the Aquaport seem to be associated with fewer postoperative complications, an adequate vault should be maintained.[8,11]

Currently, the gold-standard for ICL size choice is the Orbscan II® but determining the appropriate lens size is still a challenge, which makes the vault evaluation fundamental in the follow-up of these patients. The most commonly used methods to evaluate the vault size are the Scheimpflug tomography and the anterior segment optical coherence tomography (SA-OCT), which also provide measurements of other important anterior segment parameters, such as the ACD.[12] Taking this into consideration, our purpose was to evaluate the rate of agreement in the measurement of the vault size between the Pentacam®, the Anterion® and the Spectralis®.

MATERIAL AND METHODS

This study is a cross-sectional analysis of eyes previously submitted to ICL implantation, observed in a refractive surgery outpatient clinic between the 1st of June and the 31st of August 2022, in Centro Hospitalar Universitário do Porto.

The inclusion criteria for ICL implantation were age between 21 and 40 years old, refractive stability for more than 1-year, pupillary diameter equal or inferior to 6 mm, ACD (from endothelium) equal or superior to 3.0 mm and a central endothelial cell count equal or superior to 2500/mm^2. Eyes were excluded from surgery in the presence of corneal ectasia, cataract, previous refractive surgery, history of glaucoma, intraocular inflammation or significant anterior segment or retinal pathology.

The lens size choice was based on the white-to-white measurements obtained with Orbscan II® corneal topography system (Bausch & Lomb, Orbtek Inc., Salt Lake City, UT, USA) and according to the manufacturer indications. The ICL implanted was the Visian ICL V4c® (STAAR Surgical, Monrovia, CA, USA). In the presence of an astigmatism superior to 1 Diopter (D) a toric lens was implanted. All surgical procedures were performed by three experienced refractive surgeons. During the surgical procedure, a paracentesis was performed, followed by filling of the anterior chamber with an ophthalmological viscosurgical device (2% hydroxypropyl methylcellulose). The ICL was then inserted through a 3.2 mm temporal clear cornea incision, using an injector cartridge. The ICL was initially positioned over the iris and then, with the aid of a lens manipulator, was positioned in the posterior chamber. After the correct positioning of the lens was achieved, the viscosurgical device was washed out from the anterior chamber and a miotic agent was instilled. The corneal incisions were then hydrated, and a subconjunctival antibiotic and steroid were administered. The postoperative medication consisted of a topical antibiotic, steroid and non-steroid anti-inflammatory drug and an oral steroid in a tapering schedule.

Our primary outcome was the comparison of the vault measurement between the Pentacam HR® (OCULUS, Optikgerate GmbH, Wetzlar, Germany), the Anterion® (Heidelberg Engineering, Inc, Heidelberg, Germany) and the Spectralis® (HRA+OCT, anterior segment module, Heidelberg Engineering, Inc, Heidelberg, Germany) anterior segment optical coherence tomography (SA-OCT). The secondary outcome was the comparison of the ACD between the Pentacam® and the Anterion®.

The demographic data and the pre-operative best corrected visual acuity, spherical equivalent, white-to-white distance (Pentacam®) and ACD (Pentacam®) were also recorded.

The Pentacam HR® is a rotating Scheimpflug camera that turns around the optical axes of the eye and generates images in three dimensions, creating an 3D model of the anterior segment of the eye.

The Anterion® is a swept-source OCT (SS-OCT) that uses a 1300 nm light source to obtain B-scans of the eye with an axial resolution inferior to 10 μm, a lateral width of 16.5 mm and an axial depth of 14 mm. The long wavelength allows the evaluation of the entire anterior segment, and the lateral scan SS-OCT allows for cross-sectional images, supplying data of different parameters.

The HRA+OCT Spectralis® is a spectral domain OCT (SD-OCT), that allows acquisition of images of the anterior segment.

All images of the same patient were performed on the same day, by the same experienced technician. The exams were performed in a random order for each patient, in a dim room and in a seating position, according to the manufacturer indications. The eye was guided by an internal fixation light. The horizontal median images were used for analysis and the measurements were obtained using the on-screen calibration system. The use of the zoom tool was allowed. Vault and ACD measurements were performed by two experienced refractive surgeons (Observer 1 [O1] and Observer 2 [O2]). All images were evaluated in the same room, with the same light conditions, with screen settings standardized to the highest possible resolution. Images were randomly divided into three groups, with one of the images of each eye allocated to each of the groups. Each group contained a balanced mixture of Pentacam®, Anterion® and Spectralis® images. The images of each group were analyzed independently by the two observers in a randomized order. Images of each group were analyzed one week apart from each other.

The vault was defined as the perpendicular distance between the central posterior surface of the ICL and the anterior crystalline lens surface and the ACD as the perpendicular distance between the central corneal endothelium and the anterior surface of the crystalline lens capsule.

This study was performed in accordance with the Declaration of Helsinki in its latest amendment (2013). Patient confidentiality was assured.

Statistical analysis was performed using IBM SPSS Statistics 26. Normality of data was assessed using the Kolmogorov-Smirnov test. Continuous variables are summarized as mean and standard deviation. Categorical variables are summarized as relative frequencies. The agreement between exams and between observers was assessed with an intraclass correlation coefficient (ICC) for two mixed factors for consistency and absolute agreement: values <0.5 indicate weak agreement, between 0.5 and 0.75 indicate moderate agreement, between 0.75 and 0.9 indicate good agreement and >0.9 indicate excellent agreement.[13] All values are presented with the respective 95% confidence interval (CI). The differences in values between the different devices were evaluated using paired T tests. For correlations between devices the Pearson and Spearman correlations were used. A p value inferior to 0.05 was considered statistically significant.

RESULTS

Fifty-five eyes of 30 patients were included. Mean age was 31.5±5.9 years old and 70.0% were women. The baseline characteristics are summarized in Table 1.

Table 1. **Baseline characteristics**

Mean age (mean ± SD, y)	31.5±5.9
Anterior chamber depth (mean ± SD, mm)	3.2±1.8
White-to-white distance (mean ± SD, mm)	11.9±0.4
Spherical equivalent (mean ± SD, D)	-8.3±3.9
Sphere (mean ± SD, D)	-8.1±3.2
Cylinder (mean ± SD, D)	-1.4±1.3
Best-corrected visual acuity (mean ± SD, logMAR)	0.09±0.10
Toric ICL (%)	60.0%
ICL Sphere (mean ± SD, D)	-9.7±3.8
ICL cylinder (mean ± SD, D)	-1.7±1.3

y – years; SD – standard deviation; D – diopters; ICL – implantable collamer lens.

Regarding the vault measurement, for both observers, the ICC for absolute agreement was excellent between the Anterion® and the Spectralis® and good between the Pentacam® and the Anterion® and between the Pentacam® and the Spectralis®. The ICC for consistency for both observers was excellent between the Pentacam® and the Anterion®, between the Pentacam® and the Spectralis® and between the Anterion® and the Spectralis®. The ICC values for vault measurements are summarized in Table 2. The interobserver agreement was excellent (0.992 (CI [0.987-0.995], *p*<0.001)) for the Pentacam®, the Anterion® (1.000 (CI [0.999-1.000], *p*<0.001)) and the Spectralis® (1.000 (CI [0.999-1.000], *p*<0.001)).

Table 2. **Agreement between vault measurements**

VAULT	
ABSOLUTE AGREEMENT	
OBSERVER 1	
Pentacam® *vs* Anterion®	0.831 (CI [-0.054-0.948], *p*<0.001)
Pentacam® *vs* Spectralis®	0.825 (CI [-0.101-0.947], *p*<0.001)
Anterion® *vs* Spectralis®	0.972 (CI [0.972-0.953], *p*<0.001)
OBSERVER 2	
Pentacam® *vs* Anterion®	0.849 (CI [-0.050-0.955], *p*<0.001)
Pentacam® *vs* Spectralis®	0.836 (CI [-0.082-0.950], *p*<0.001)
Anterion® *vs* Spectralis®	0.974 (CI [0.955-0.985], *p*<0.001)
CONSISTENCY	
OBSERVER 1	
Pentacam® *vs* Anterion®	0.932 (CI [0.883-0.960], *p*<0.001)
Pentacam® *vs* Spectralis®	0.934 (CI [0.887-0.962], *p*<0.001)
Anterion® *vs* Spectralis®	0.972 (CI [0.952-0.984], *p*<0.001)
OBSERVER 2	
Pentacam® *vs* Anterion®	0.942 (CI [0.901-0.966], *p*<0.001)
Pentacam® *vs* Spectralis®	0.938 (CI [0.894-0.964], *p*<0.001)
Anterion® *vs* Spectralis®	0.973 (CI [0.954-0.984], *p*<0.001)

ICC – intraclass correlation coefficient; CI – 95% confidence interval.

The vault measurements obtained with Pentacam® were inferior to those obtained with the Anterion® and the Spectralis® (*p*<0.001) for both observers. There were no differences between the Anterion® and the Spectralis® (*p*>0.697). The differences between devices are summarized in Table 3.

Table 3. **Comparison of measurements between devices**

VAULT	
OBSERVER 1	
Pentacam® *vs* Anterion®	257±155 μm *vs* 376±195 μm, *p*<0.001
Pentacam® *vs* Spectralis®	257±155 μm *vs* 378±187 μm, *p*<0.001
Anterion® *vs* Spectralis®	376±195 μm *vs* 378±187 μm, *p*=0.789
OBSERVER 2	
Pentacam® *vs* Anterion®	260±156 μm *vs* 375±195 μm, *p*<0.001
Pentacam® *vs* Spectralis®	260±156 μm *vs* 378±187 μm, *p*<0.001
Anterion® *vs* Spectralis®	375±195 μm *vs* 378±187 μm, *p*=0.697
ANTERIOR CHAMBER DEPTH	
OBSERVER 1	
Pentacam® *vs* Anterion®	3009±177 μm *vs* 3114±195 μm, *p*<0.001
OBSERVER 2	
Pentacam® *vs* Anterion®	3010±199 μm *vs* 3095±201 μm, *p*<0.001

Note: values are presented as mean and standard deviation.

The differences in the vault measurements between the Anterion® and the Pentacam® correlated positively with the increase of the vault size in the Anterion® (O1: R(53)=0.629, *p*<0.001; O2: R(53)=0.676, *p*<0.001) and the Pentacam® for O2 (R(53)=0.297, *p*=0.028) but not for O1 (R(53)=0.247, *p*=0.069). The differences in the vault measurements between the Spectralis® and the Pentacam® correlated positively with the increase of the vault value in the Spectralis® (O1: R(53)=0.570, *p*<0.001; O2: R(53)=0.569; *p*<0.001) but not in the Pentacam® (O1: R(53)=0.172, *p*=0.208; O2: R(53)=0.149, *p*=0.278). There was a positive correlation between the difference in vault measurements between the Anterion® and the Pentacam® and the increase of the pupillary diameter in the Anterion® (O1: R(53)=0.400, *p*=0.002; O2: R(53)=0.365, *p*=0.006) but not with the increase of pupillary diameter in the Pentacam® (O1: R(53)=0.247, *p*=0.069; O2: R(53)=0.241, *p*=0.076). The differences in the vault measurements between the Spectralis® and the Pentacam® correlated positively with the increase of the pupillary diameter in the Spectralis® (O1: R(53)=0.395, *p*=0.003; O2: R(53)=0.329, *p*=0.014) but not in the Pentacam® (O1: R(53)=0.062, *p*=0.655; O2: R(53)=0.128, *p*=0.352). Mean pupillary distance values are summarized in Table 4. Statistically significant correlations are graphically represented in Fig. 1.

The Pentacam® rated significantly more eyes with a vault size outside the desirable interval (250-750 μm) than the Anterion® (O1: 54.5% *vs* 38.2%, *p*<0.001; O2: 50.9% *vs* 38.2%, *p*<0.001) and the Spectralis® (O1: 54.5% *vs* 29.1%, *p*<0.001; O2: 50.9% *vs* 32.7%, *p*<0.001).

For ACD measurements, the ICC for absolute agree-

Table 4. Pupillary diameter	
PENTACAM®	
Observer 1	3.1±0.6 mm
Observer 2	3.1±0.7 mm
ANTERION®	
Observer 1	5.1±1.0 mm
Observer 2	5.0±1.2 mm
SPECTRALIS®	
Observer 1	4.5±1.1 mm
Observer 2	4.5±1.1 mm

Note: values are presented as mean and standard deviation.

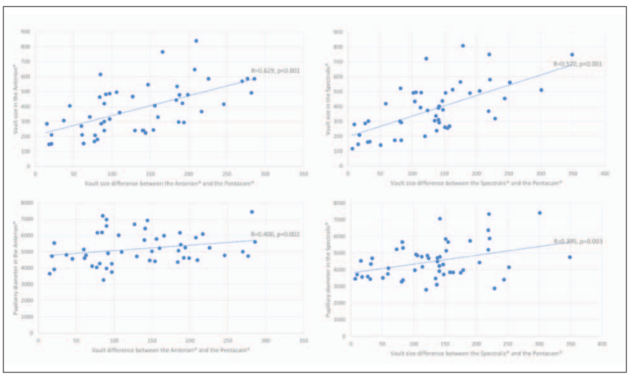

Figure 1. **Correlations with vault size differences between devices.**

Note: For simplification purposes, only measurements obtained by Observer 1 are represented.

Table 5. Agreement of anterior chamber depth measurements	
PENTACAM® VS ANTERION®	
ABSOLUTE AGREEMENT	
Observer 1	0.819 (CI [0.382-0.924], p<0.001)
Observer 2	0.790 (CI [0.551-0.892], p<0.001)
CONSISTENCY	
Observer 1	0.880 (CI [0.795-0.930], p<0.001)
Observer 2	0.830 (CI [0.708-0.901], p<0.001)

ICC – intraclass correlation coefficient; CI – 95% confidence interval.

ment and for consistency between the Pentacam® and the Anterion® was good for both observers. The ICC values for ACD measurements are summarized in Table 5. The inter-observer agreement was excellent for Pentacam® (0.955 (CI [0.923-0.974], p<0.001)) and good for Anterion® (0.863 (CI [0.767-0.920], p<0.001)). The measurements obtained with Pentacam® for ACD were inferior to those obtained with the Anterion® for both observers (p<0.001). The differences between measurements are summarized in Table 3.

DISCUSSION AND CONCLUSION

In our study we found that there was an excellent agreement between the Spectralis® and the Anterion®, without statistically significant differences between devices, indicating that they could be used interchangeably to measure the vault value in patients with an ICL. On turn, the absolute agreement between the Pentacam® and the Anterion® and between the Pentacam® and the Spectralis® was only good. Furthermore, the Pentacam® rated significantly more eyes with a vault size outside the desirable interval, which indicates that the differences between devices are clinically relevant. Despite this, the ICC for consistency in vault measurements between the Pentacam® and the other devices was excellent, indicating that Pentacam® provides consistently lower values than the other devices. The ICC for consistency in ACD measurements was only good, which might suggest that for larger measurements the variability is superior. Taking this into consideration, the Pentacam® cannot be used interchangeably with the Anterion® and the Spectralis®.

Few studies compare the vault measurements between different devices. Almorín-Férnandez-Vigo *et al* evaluated the agreement of the vault measurements between a Scheimpflug tomography and an AS-OCT. In line with our findings, the authors verified that the ICC for consistency of vault measurements was 0.960 (95% CI, 0.938-0.974), with an ICC for absolute agreement of 0.828 (95% CI, −0.43-0.954), which indicate good to excellent agreement. Despite this, the mean vault obtained with the AS-OCT was higher than the vault obtained with the Scheimpflug tomography, and the authors concluded that these devices could not be used interchangeably.[12]

Wan *et al* also compared the vault and ACD measurements between the Pentacam® and an AS-OCT (Model 1000, Carl Zeiss Meditec, USA). While the ICC results indicated high reliability between the studied devices, measurements were superior with AS-OCT when compared to the Pentacam®. Hence, the authors also concluded that these devices could not be used interchangeably.[14]

In our study, the differences in vault size between devices seem to positively correlate with the vault size, meaning that as vault size increases, the difference between devices also increases, as previously shown by Almorín-Férnandez-Vigo *et al*.[12] Despite this, in our study, contrary to the findings of Almorín-Férnandez-Vigo *et al*, this relation is only significant for OCT-based devices, suggesting that measurements performed with the Pentacam® may be less susceptible to variability originated by the increase of the vault size. Furthermore, there also seems to be a correlation between the differences in vault size and the pupillary diameter measured in the Anterion® and the Spectralis®, the difference being superior with increasing pupillary diameter, as previously suggested.[12]

Many studies have compared the ACD between different devices in eyes not submitted to refractive surgery, with different findings. Li et al compared the ACD between the Pentacam® and an AS-OCT (CASIA2®, Tomey Corporation, Nagoya, Japan), finding that there were no differences between the different devices.[15] Wang *et al* compared the ACD between 4 devices: Pentacam®, Sirius® (SCHWIND eye-tech-solutions, Germany), Galilei G2® (Ziemer Ophthalmic System AG, Port, Switzerland) and Visante® AS-OCT (Carl Zeiss Meditec AG, Germany). The authors found that there was a good agreement between them, indicating that they could be used interchangeably in most clinical situations. Despite this, the measurements obtained with the Galilei G2 were slightly higher and the measurements obtained with the Pentacam® were slightly lower than those provided by the other devices. Nevertheless, the authors considered that these differences, although statistically significant, were not clinically relevant.[16] O'Donnell *et al* also found that the Visante® AS-OCT tended to give higher readings than both the LenStar® (Haag-Streit, Koeniz, Switzerland), and the Pentacam®, concluding that they should not be used interchangeably.[17] Pardeshi et al compared the CASIA SS-1000® (Tomey Corporation, Nagoya, Japan) with the Anterion®, finding a good agreement in the ACD measurements.[18] Another study also found a good agreement between the Anterion® and the CASIA2, but found that the values obtained with the Anterion® were inferior.[19] Tañá-Rivero et al found that the mean ACD values obtained with the Anterion® and the Pentacam® were similar.[20] Doors et al compared the ACD between different devices (Orbscan II, Pentacam®, Visante® AS-OCT) in eyes submitted to anterior chamber phakic intraocular lens, finding that ACD measurements using Orbscan II® were smaller than those of the other two imaging devices and that measurements with the AS-OCT were higher than those obtained with the Pentacam®.[21]

In line with some of the previous studies, in our study the measurements obtained with the Pentacam® were inferior to those obtained with both the Spectralis® and the Anterion®. Many factors can contribute to the differences found between these devices. Firstly, each device has a different image capture technology. While the Spectralis® is a SD-OCT, the Pentacam® is based on a Scheimpflug camera, and the Anterion® uses a SS-OCT. Furthermore, the presence of the ICL itself may lead to a distortion of the image processing that could also contribute to the differences found.[14] As literature comparing the differences between devices in eyes with and without phakic intraocular lens are lacking, it is not known how the ICL impacts the measurements in the different devices. The different sources of guidance light may also play a role in the differences obtained, inducing different degrees of pupil contraction and accommodation.[14] It is also important to note that the Pentacam® produces images with lower quality, when compared with SA-OCT and with the Anterion®. While there is a line defining the edge of the anterior crystalline lens, the system does not define the ICL borders. If the edges are not clearly defined, the calliper can be placed in a slightly different place than the one that corresponds to the actual location of the structure, leading to tendency to over or underestimate the real distance, which could contribute for the lower values obtained with Pentacam®.

This study has some limitations, in particular the small number of participants. As the measurements were made in three different devices, the measurement location may have varied slightly between them. Furthermore, the comparison of the ACD was only made between the Pentacam® and the Anterion®, as the Spectralis® anterior segment module does not allow for the obtention of an image encompassing the entire anterior segment at once. Finally, we did not evaluate which device provides the more accurate measurement. Despite this, this is one of the very few studies comparing anterior segment measurements in eyes with an ICL and, to our best knowledge, the first study comparing measurements of the vault size between the Anterion® and other devices.

In conclusion, understanding how measurements vary between the different devices available is fundamental. If one device systematically underestimates the vault size, it can give a false notion of security, underestimating the risk of complications, such as endothelial cell loss and increase in the intraocular pressure. On turn, in the presence of a low vault, the clinician may overestimate the risk of developing cataract. Taking this into consideration, future studies evaluating which device provides the more accurate measurements are fundamental to guide clinical decisions.

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All authors contributed to the study design and data acquisition and interpretation. All authors reviewed the manuscript and approved the final version. All authors agreed to be held responsible for the manuscript's contents.

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