EFFECTS OF DIFFERENT POST LENS SALINE FILLING SOLUTIONS ON MIDDAY FOGGING IN HABITUAL SCLERAL LENS WEARERS

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Introduction

Fogging of vision while wearing ScCLs is a common complication that can be occur after minutes to hours of lens wear[1]. Different aspects can contribute to this problem; one can be related to corneal edema, others related to the anterior contact lens surface, as the presence of front surface debris or a poor anterior surface wettability. Another aspect is related to the post lens tear reservoir turbidity induced by particulate matter accumulation[1]. This last cause is defined as “mid-day fogging” (MDF) and is thought to occur in 20% to 33% of all patients who wear ScCLs[2]. Although the cause of MDF is unknown, its presence appears to be multi-factorial, with a number of variables affecting the clinical outcome[3]. The debris responsible for turbidity seems to have lipid, protein, cell fragments[4], and Leukocytes[2] components.

Purpose

The aim of the study was to evaluate the effect of different post-lens saline filling solutions used during ScCL wear on objective quality of vision (OQV) and subjective ocular straylight (OS) in subjects with MDF.

Methods

For this clinical study, we selected 12 eyes with keratoconus and 6 eyes with keratoplasty (PK) with no corneal opacities and with fogging of vision after several hours of ScCL wear. All lenses in use induced the best refractive correction and presented a central clearance higher than 150µm after a minimum of 6 hours of wear and a turbidity of post lens solution confirmed with two-dimensional cross-sectional images obtained with a Spectral Domain OCT system (Revo NX, Optopol Technology). OQV was evaluated using the modulation transfer function (MTF) cut off, Strehl ratio (SR) and objective scatter index (OSI) measured using a double pass instrument (HD Analyzer, Visiometrics) (Fig.5,6). OSI quantifies both ocular light scatter and aberrations and is defined as the ratio between the light intensity in a peripheral annular area (from 12 to 20 min of arc) and the central peak (1 min of arc); an increase of its value is associated with a reduction of optical quality of the retinal image[5]. Subjective OS was evaluated using the compensation comparison method obtained with a straylight meter (C-Quant, Oculus)[6]. All measurements were repeated in two different days after a minimum of 6 hours of wear with the lens in place one day using a common unpreserved pH-Balanced Saline Solution (US) (Soluzione Salina, Alcon) and the second one using an unpreserved saline with electrolytes K+, Ca++, Mg++ (US+E) (Isosol, Vita Research) as filling solutions. To avoid possible artefacts induced by a reduction of anterior lens surface wettability, 10min before the measurements, 2 drops of lens cleaning drops were used (Reset, Vita Research).To avoid that baseline values could be influenced by the possible effect induced by the corneal edema, they were obtained the first day of study after the ScCL were removed and reinserted with fresh US.

Results

Data were analyzed using IBM SPSS Statistics (version 22, Armonk, USA) and the relationships between the variables were assessed with the repeated-measures ANOVA p-value <0.05 was taken to indicate significance. The baseline values for MTF cut off, SR, OSI and OS for eyes with keratoconus and PK were respectively (mean±SD) 24.80±5.51c/deg, 0.16±0.03, 1.50±0.39, 1.12±0.13log(s) and 23.98±8.90c/deg, 0.17±0.05, 1.46±0.17, 1.17±0.23log(s). In eyes with keratoconus, the MTF cut off, SR, OSI and OS comparison with baseline were not significantly different (p>0,05) when US+E was used (23.03±5.84c/deg, 0.14±0.03, 1.73±0.61, 1.18±0.09log(s)) while were significantly different (p<0,05) when US was used (17.61±7.44c/deg, 0.10±0.03, 2.50±1.14, 1.46±0.29log(s)). Similar results were found in eyes with PG where MTF cut off (Fig.1), OSI (Fig.2) and OS (Fig.3) comparison with baseline were not significant different (p>0,05) when US+E was used (22.61±8.96c/deg, 1.70±0.83, 1.29±0.21log(s)) while were significant different (p<0,05) when US was used (11.43±5.52c/deg, 2.88±1.02, 1.58±0.17log(s)). Just SR was significantly different for both solutions (US+E 0.15±0.05 and US 0.11±0.08) (Fig.4).

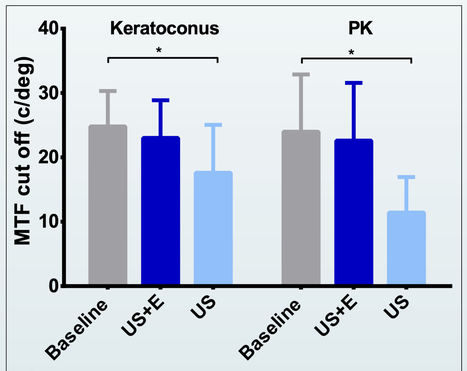

Fig.1
*MTF cut off measured as baseline and with saline solutions tested in keratoconic and PK eyes (*p<0,05)*

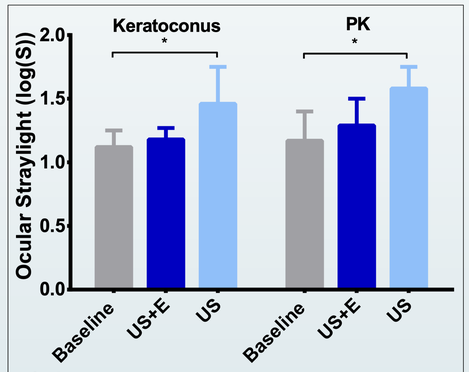

Fig.2
*OSI measured as baseline and with saline solutions tested in keratoconic and PK eyes (*p<0,05)*

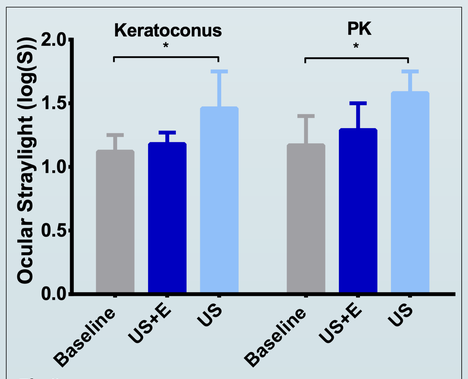

Fig.3
*Ocular straylight measured as baseline and with saline solutions tested in keratoconic and PK eyes (*p<0,05)*

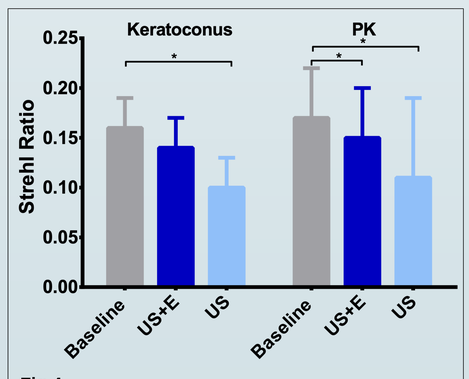

Fig.4
*Strehl Ratio measured as baseline and with saline solutions tested in keratoconic and PK eyes (*p<0,05)*

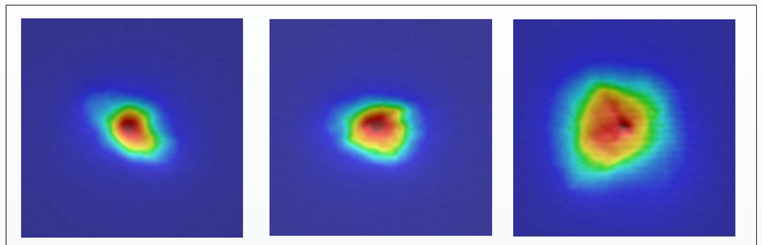

Fig.5
Retinal double pass image obtained on a Keratoconic eye using different saline solution

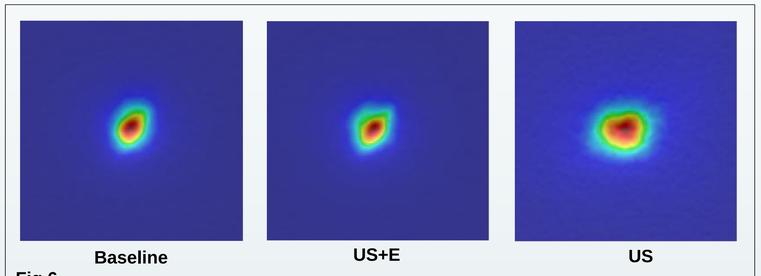

Fig.6
Retinal double pass image obtained on a PK eye using different saline solution

Conclusion

To manage the MDF, different solutions have been proposed as high viscosity, ion containing, preservative free artificial tears to fill the ScCL or to adjust the lens design to create a thinner, uniform (plano lens shape) post-lens tear reservoir,[7,8] though considering its multifactorial origin, it is not likely that there is one universal solution to reduce this problem. In conclusion, from our experience the decrease of quality of vision with midday fogging during the ScCL wear can be improved using as a filling solution an unpreserved saline with balanced essential electrolytes. This positive behavior could be associated with the ion presence that have a nutrition effect on the cornea[8].

References

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