






High Molecular Weight Hyaluronic Acid, Trehalose and Sacha Inchi Oil Drops in Post-Cataract Dry Eye Symptoms

Impacto do Colírio de Ácido Hialurónico de Alto Peso Molecular, Trealose e Óleo de Sacha Inchi nos Sintomas de Olho Seco Pós-Cirurgia de Catarata

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ABSTRACT

INTRODUCTION: Following cataract surgery, many patients experience persistent dry eye symptoms, adversely affecting their quality of life. These symptoms are particularly prevalent among elderly patients and may be exacerbated by topical anesthesia, surgical lighting exposure, and postoperative medications preservatives. Effective management of these symptoms is crucial for patient satisfaction. This study aims to evaluate the efficacy of high molecular weight hyaluronic acid/trehalose/sacha inchi oil eye drops in alleviating postoperative discomfort in patients undergoing cataract surgery.

METHODS: A prospective, randomized and comparative study was conducted. Prior to cataract surgery and at four weeks postoperation, assessments were conducted for dry eye symptoms using an ocular surface disease index (OSDI) questionnaire validated to Portuguese language.

Patients were divided into two groups: Group A received hyaluronic acid/trehalose/sacha inchi oil eye drops five times daily in addition to standard postoperative drops, while Group B received only the standard postoperative drops for four weeks.

RESULTS: Seventy-six patients were enrolled: 41 in Group A (73.7 ± 7.0 years) and 35 in Group B (75.1 ± 5.9 years). There were no significant differences between the groups regarding age, gender, best corrected visual acuity pre- and postoperatively, or mean pre-operative OSDI scores. Significant improvement in OSDI scores was observed in both groups following cataract surgery. However, the reduction in symptoms was more pronounced in Group A, with mean OSDI scores at four weeks showing a significant difference between the two groups (18.4 in Group A and 24.7 in Group B, $p < 0.05$).

CONCLUSION: The combination of hyaluronic acid/trehalose/sacha inchi oil eye drops proved highly effective in relieving dry eye symptoms following cataract surgery. Notably, we hypothesize that the decrease in OSDI scores might be primarily related to the six vision-related function questions on the OSDI questionnaire, highlighting the positive impact of cataract surgery on these aspects. Although dry eye symptoms might be expected to worsen post-surgery, leading

to a higher overall OSDI score, the observed improvement suggests that the benefits of surgery outweigh the anticipated aggravation of dry eye symptoms. Thus, addressing these symptoms effectively is crucial for optimizing clinical outcomes and enhancing patient satisfaction.

KEYWORDS: Cataract Extraction/adverse effects; Dry Eye Syndromes/drug therapy; Dry Eye Syndromes/etiology; Hyaluronic Acid; Lubricant Eye Drops; Ophthalmic Solutions; Postoperative Complications; Tears; Trehalose.

RESUMO

INTRODUÇÃO: Após a cirurgia de catarata, muitos doentes apresentam sintomas persistentes de olho seco, sobretudo comuns em idosos, podendo ser agravados pela anestesia tópica, exposição à luz cirúrgica e conservantes em medicamentos pós-operatórios. Gerir esses sintomas é crucial para a satisfação dos doentes. Este estudo visa avaliar a eficácia da lágrima artificial de ácido hialurónico/trealose/óleo de *sacha inchi* no desconforto pós-operatório em doentes submetidos a cirurgia de catarata.

MÉTODOS: Foi realizado um estudo prospetivo, randomizado e comparativo. Avaliações dos sintomas de olho seco foram feitas através do questionário *ocular surface disease index* (OSDI) antes e quatro semanas após cirurgia de catarata. Os doentes foram divididos em dois grupos: Grupo A usou a lágrima artificial cinco vezes ao dia, além das gotas pós-operatórias *standard*; o Grupo B usou apenas as gotas pós-operatórias *standard*.

RESULTADOS: Setenta e seis doentes foram incluídos: 41 no Grupo A ($73,7 \pm 7,0$ anos) e 35 no Grupo B ($75,1 \pm 5,9$ anos). Não houve diferenças entre grupos relativamente à idade, género, melhor acuidade visual corrigida tanto no pré como no pós-operatório, e pontuações médias de OSDI pré-operatórias.

Foi observada uma melhoria significativa na pontuação de OSDI em ambos os grupos após a cirurgia de catarata. No entanto, a redução dos sintomas foi mais pronunciada no grupo tratado com ácido hialurónico/trealose/óleo de *sacha inchi*. Após quatro semanas, as pontuações médias de OSDI foram significativamente diferentes entre os grupos (18,4 no Grupo A e 24,7 no Grupo B, $p < 0,05$).

CONCLUSÃO: O colírio de ácido hialurónico/trealose/óleo de *sacha inchi* mostrou-se eficaz no alívio dos sintomas de olho seco pós-cirurgia de catarata. A hipótese que parece mais provável é que a redução dos *scores* OSDI esteja principalmente relacionada com as questões sobre visão no questionário, evidenciando o impacto positivo da cirurgia. Embora se esperasse um agravamento dos sintomas de olho seco após a cirurgia, a melhoria observada indica que os benefícios da cirurgia superam este agravamento. Ainda assim, uma proporção significativa de doente ainda experiência olho seco, pelo que tratar eficazmente estes sintomas é essencial para melhorar os resultados clínicos e a satisfação dos doentes.

PALAVRAS-CHAVE: Ácido Hialurónico; Colírios Lubrificantes; Complicações Pós-Operatórias; Extração de Cataratas/efeitos adversos; Síndromes do Olho Seco/tratamento farmacológico; Síndromes do Olho Seco/etiologia; Soluções Oftálmicas; Trealose.

INTRODUCTION

Cataract surgery is a highly effective procedure commonly performed to restore vision in patients with cataracts.¹ However, despite the success in improving visual acuity, many patients report significant postoperative ocular discomfort, often linked to the onset or exacerbation of dry eye disease (DED). DED symptoms following cataract surgery are not uncommon, with studies estimating an incidence of approximately 32% at two weeks postopera-

tively, and include conjunctival hyperemia, ocular surface irritation, itching, tearing, and the sensation of a foreign body in the eye.² These symptoms can persist for weeks or even months after surgery, significantly impacting patients' quality of life by affecting daily activities and leading to lower patient satisfaction with the surgical outcome.³ This issue is particularly pronounced among the elderly population, who not only represent the majority of cataract surgery patients but also often have a higher prevalence of pre-existing subclinical or clinical dry eye conditions.¹ Cat-

aract surgery can further aggravate these conditions due to various intraoperative and postoperative factors, such as the use of topical anesthetics, exposure to bright operating microscope light, and postoperative medications containing preservatives, all of which can disrupt the stability of the tear film. Additionally, the mechanical trauma to the ocular surface during surgery can exacerbate symptoms.⁴ Considering the high incidence of DED following cataract surgery and its substantial impact on patient comfort and satisfaction, it is crucial to understand the effects of DED and the importance of managing this condition effectively to improve patient outcomes and overall quality of life.^{1-3,5,6}

This study aims to evaluate the efficacy of high molecular weight hyaluronic acid/trehalose/sacha inchi oil (i-fresh total®) eye drops on postoperative discomfort in patients undergoing cataract surgery.

MATERIAL AND METHODS

A prospective study was conducted at the Ophthalmology Department of Unidade Local de Saúde de São João. Participants were selected from the cataract surgery waiting list over 3 months (January to March 2024). All patients scheduled for cataract surgery during this time, who had no exclusion criteria, were included consecutively as they presented in the operating room. This approach allowed for random encounters with eligible patients, as cataract surgeries are scheduled without specific selection criteria.

The patients were then divided into two groups. In the postoperative period following cataract surgery, Group A received preservative-free eye drops containing 2% hyaluronic acid, 2% trehalose, and 0.1% sacha inchi oil, administered five times daily, along with the standard postoperative regimen of levofloxacin 5 mg/mL, dexamethasone 1 mg/mL, and flurbiprofen 0.3 mg/mL, which were not preservative-free. The levofloxacin, dexamethasone, and flurbiprofen drops were applied five times daily during the first two weeks, and three times daily during the second two weeks. Group B received only the standard postoperative drops for four weeks in the same regimen. The group assignment was randomized, with the first half of the patients submitted to surgery during a surgery day assigned to Group A and the second half assigned to Group B. The exclusion criteria included any prior treatments for dry eye, such as the use of topical lubricants in the pre-operative period, as well as the need to initiate or intensify topical lubrication during the postoperative period. Dry eye symptoms were assessed using the Portuguese-validated Ocular Surface Disease Index (OSDI) questionnaire at two time points: during the pre-operative assessment on the day of cataract surgery, and four weeks after the operation during the follow-up consultation.¹ Patients rate their responses on a scale from 0 to 4, with 0 indicating “none of the time” and 4 indicating “all of the time.” The OSDI overall and subscale scores range from 0 to 100. Based on their OSDI final score, patients can be categorized as having a normal ocular surface (0-12 points) or

as having mild (13-22 points), moderate (23-32 points), or severe (33-100 points) ocular surface disease.⁸

Data such as age, gender and best corrected-visual acuity (BCVA) pre-operative and four weeks post-surgery were also collected. Visual acuity was measured using a Snellen chart and converted to logarithm of the minimum angle of resolution (logMAR) equivalents for statistical analysis.

The study was conducted according to the tenets of the Declaration of Helsinki and all volunteers gave their consent for the analysis and publication of the collected data.

Statistical analysis was performed using SPSS software, version 22 (IBM, Chicago, IL). The Shapiro-Wilk test was used to assess the normal distribution of numerical data. The Chi-square test was used to compare categorical variables between groups, such as gender. To compare differences between groups, paired samples t test was used. A *p*-value less than 0.05 was considered statistically significant. Frequencies and percentages were used to describe qualitative variables and quantitative variables were expressed as mean ± standard deviation (SD).

RESULTS

Seventy-six eyes from seventy-six patients were included in the study: 41 in Group A and 35 in Group B. The mean age was 73.7 ± 7.0 years in Group A and 75.1 ± 5.9 years in Group B. The male-to-female ratio was 16:25 in Group A and 14:21 in Group B. There were no significant differences between the groups in terms of age, gender, or BCVA either before or after the surgery (Table 1).

Table 1. Comparison of age (years), gender, pre- and postoperative best corrected visual acuity between group A and group B.

			<i>p</i> value
Age (years)	Group A	73.7±7.0	0.360
	Group B	75.1±5.9	
Gender (male/female)	Group A	16(39.0) / 25(61.0)	0.794
	Group B	14(40.0) / 21(60.0)	
Pre-operative BCVA	Group A	0.320±0.150	0.937
	Group B	0.317±0.098	
Postoperative BCVA	Group A	0.027±0.055	0.927
	Group B	0.026±0.051	

Values are expressed as n (%) or mean±SD.

Abbreviations: BCVA, Best Corrected Visual Acuity.

The severity of pre-operative dry eye symptoms in both groups is represented in Table 2.

There were no differences between the groups regarding mean pre-operative OSDI score (40.4 in group A and 38.2 in group B, *p*=0.722) but a significant improvement in OSDI score was observed in both groups following cataract surgery (39.4 to 21.3, *p*<0.05), in group A (40.4 to 18.4, *p*<0.05) and group B (38.2 to 24.7, *p*<0.05) (Table 3).

However, the OSDI score reduction was more pronounced in the group A. This difference was statistically

Table 2. Severity of dry eye symptoms in groups A and B, according to OSDI score.

Group A	Normal ocular surface	7 (17.1)
	Mild ocular surface disease	4 (9.8)
	Moderate ocular surface disease	8 (19.5)
	Severe ocular surface disease	22 (53.7)
Group B	Normal ocular surface	8 (22.9)
	Mild ocular surface disease	3 (8.6)
	Moderate ocular surface disease	4 (11.4)
	Severe ocular surface disease	20 (57.1)

Values are expressed as n (%).

Table 3. Comparison between OSDI score in the surgery day and OSDI score four weeks postoperative.

			p value
Group A+B	OSDI score surgery day	39.4±26.9	<0.001*
	OSDI score 4 weeks postoperative	21.3±13.7	
Group A	OSDI score surgery day	40.4±27.0	<0.001*
	OSDI score 4 weeks postoperative	18.4±13.8	
Group B	OSDI score surgery day	38.2±27.1	<0.001*
	OSDI score 4 weeks postoperative	24.7±13.0	

Values are expressed as mean±SD.

Abbreviations: OSDI, Ocular Surface Disease Index.

significant at the four-week mark, with the mean OSDI scores demonstrating a significant difference between the two groups (18.4 in Group A and 24.7 in Group B, $p<0.05$) (Table 4).

Table 4. Comparison of OSDI score in the surgery day and four weeks postoperative between group A and B.

			p value
OSDI score surgery day	Group A	40.4±27.0	0.722
	Group B	38.2±27.1	
OSDI score 4 weeks postoperative	Group A	18.4±13.8	0.048*
	Group B	24.7±13.0	

Values are expressed as mean±SD.

Abbreviations: OSDI, Ocular Surface Disease Index.

DISCUSSION

Phacoemulsification is the most frequently performed ocular surgery, known for its effectiveness in restoring clear vision. However, a subset of patients reports symptoms such as eye fatigue and a persistent foreign body sensation, which can diminish overall patient satisfaction.⁹ A range of treatments exists for managing postoperative DED, with options varying from basic hydration of the ocular surface

using artificial tears to the application of eye drops that offer lubricating and cell-binding properties for enhanced therapeutic effects.³

This study assessed the variation in dry eye symptoms associated with cataract surgery.

The OSDI questionnaire was designed to quickly evaluate symptoms of ocular irritation associated with DED and their impact on vision-related functioning. This 12-item questionnaire examines dry eye symptoms and their effects on vision-related function over the past week and is divided into three subscales: ocular symptoms, vision-related function, and environmental triggers.

Regarding pre- and four-week postoperative OSDI scores, a significant decrease was observed, regardless of whether patients used eye drops containing hyaluronic acid/trehalose/sacha inchi oil. We hypothesize that this decrease might be related to the vision-related function questions on the OSDI questionnaire, highlighting the positive impact of cataract surgery. While one might expect dry eye symptoms to worsen post-surgery, leading to an increased overall score, the observed improvement suggests that the benefits of surgery outweigh the anticipated aggravation of dry eye symptoms.

Despite the decrease in OSDI scores in both groups, a more pronounced reduction was observed in the group of patients who were using hyaluronic acid/trehalose/sacha inchi oil eye drops. This suggests that the use of this type of artificial tears in the postoperative period following cataract surgery may indeed improve symptoms related to DED.

Another key finding of this study is the alarmingly high prevalence of dry eye symptoms in patients undergoing pre-operative assessment for cataract surgery, with the majority of patients classifying as moderate or severe DED. It is essential to optimize the ocular surface when preparing patients for cataract surgery. This is especially true in a public hospital setting, where the patient population is predominantly elderly, inherently placing them at a higher risk for DED and for developing dry eye in the postoperative period.¹⁰

Although we report some interesting findings, our study has several limitations that should be mentioned. Firstly, due to the prospective nature of the study and a defined recruitment period, the sample size may be limited, potentially impacting the results. Secondly, we observed that the OSDI score evaluates dry eye symptoms, vision function, and environmental triggers, which limits its ability to specifically assess dry eye symptoms. Another limitation of this study is the lack of categorization of patients based on the severity of their preoperative dry eye condition. While categorization might have offered more detailed insights, the relatively small sample size means that such a subdivision could have restricted the ability to draw meaningful conclusions. Nonetheless, the current approach provides a more accurate representation of the general population, particularly given that we are dealing with older patients. In future studies, further procedures could be implemented to gain deeper insights into the development of this condition, such as measuring

Schirmer scores, assessing tear break-up time, evaluating eyelid status, and analyzing tear osmolarity.

The combination of hyaluronic acid/trehalose/sacha inchi oil eye drops appears to have a beneficial effect following cataract surgery. While both groups experienced a reduction in OSDI scores postoperatively, certainly due to the overall visual acuity gain after the cataract removal, it is noteworthy that the group receiving hyaluronic acid/trehalose/sacha inchi oil eye drops exhibited a more significant enhancement.

CONCLUSION

Cataract surgery is an effective procedure to improve a patient's visual acuity. Nevertheless, a significant proportion of patients experience dry eye symptoms post-surgery, impacting their quality of life. Thus, it is imperative to effectively address these symptoms to optimize clinical outcomes and patient satisfaction following cataract surgery.

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CONTRIBUTORSHIP STATEMENT / DECLARAÇÃO DE CONTRIBUIÇÃO

AFP and RTM: Prepared the material, collected data, analyzed and wrote the first draft of the manuscript.

AFP, RTM and ICC: Prepared the material, collected data and analyzed.

All authors contributed to the study conception and design, commented on previous versions of the manuscript. All authors read and approved the final manuscript.

AFP e RTM: Prepararam o material, recolheram dados, analisaram e redigiram a primeira versão do manuscrito.

AFP, RTM e ICC: Prepararam o material, recolheram os dados e analisaram.

Todos os autores contribuíram para a conceção e desenho do estudo, comentaram versões anteriores do manuscrito. Todos os autores leram e aprovaram o manuscrito final.

RESPONSABILIDADES ÉTICAS

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

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ETHICAL DISCLOSURES

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