The effect of a new ocular surface modulator in controlling inflammation in an *in vitro* model of dry eye

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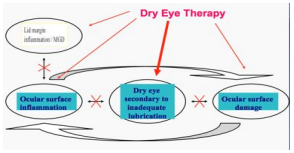
INTRODUCTION

Dry eye syndrome (DES) is a common condition that can significantly interfere with patients' quality of life, negatively affecting everyday activities such as reading, using a computer, working, and driving.
The pathogenesis of DES is very complicated, but it could be summarized in 4 key elements:[1]



DES treatment should consider all of the 4 elements, but unfortunately there are some limitations that make the disease an important problem for patients, and a reason of unsatisfaction for ophthalmologists.
One of the main reason is the *lack of a treatment that can interact with the ocular surface system and modulate inflammation.*

Currently, substitute tears available on the market are lubricants only and have limited effect on the ocular surface system.

T-LysYal (T-LYS) is a supramolecular compound containing lysine hyaluronate, thimine, and sodium chloride that form longer chains than hyaluronic acid (HA) alone and a 3D structure with nanotubes. While hyaluronic acid binds water but it is not able to move it, T-LYS can attract water and has the capacity to move it, modulating growth factors expression and inflammatory mediators.[2] Furthermore, T-LYS is more resistant to the lytic enzyme hyaluronidase than HA because of the presence of lysine hyaluronate and thimine on the target sites of the enzyme. This fact accounts for a superior stability of the product that may exert a repairing activity for a longer period. In vitro T-LYS was able to repair corneal epithelial cells damaged by dry conditions.[3]

PURPOSE

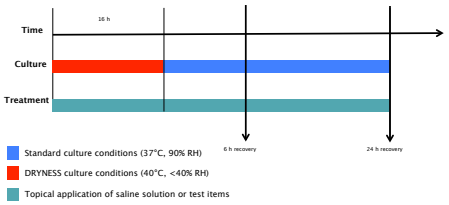
Inflammation plays an important role in dry eye syndrome (DES) pathogenesis. The aim of this study was to assess the effect of an ocular surface modulator on inflammatory markers compared to substitute tears in an in vitro model of DES.

CONCLUSION

This study has shown for the first time that it is possible to control inflammation induced by dry eye conditions by using a modulator of the ocular surface. Further in vivo studies are certainly necessary to confirm these results.

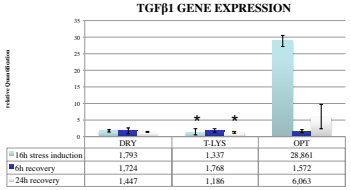
MATERIALS AND METHODS

As previously published[4] reconstructed human corneal epithelium (HCE) of 0.5 cm^2 from SkinEthic (France) has been incubated at 37 °C (+ 5% CO_2) at 90% humidity and then transferred in the defined controlled conditions (RH<40%, T>37°C, and introduction of sorbitol 0.6M for 16 hours) in order to induce dry eye (HCE-DRYNESS). During the overnight stress period and during the recovery period the ocular surface modulator (T-Lysyal [T-LYS], Sildeha, Switzerland, marketed as ReLys, Farmigea, Italy), and a substitute tear containing sodium carboxymethylcellulose 0.5%, glycerine 1%, and castor oil 0.25% (Optive Plus, Allergan, USA) were applied in the study and control group respectively. A negative control treated with 0.9% NaCl was used for comparisons. After 16, 22, and 46 hours the following parameters were quantified: mRNA expression of TGFβ1, Metalloprotease 1(MMP-1), ICAM-1, and CD44.



RESULTS

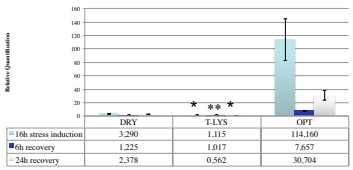
TGFβ1 GENE EXPRESSION



	DRY	T-LYS	OPT
16h stress induction	1,793	1,337	28,861
6h recovery	1,724	1,768	1,572
24h recovery	1,447	1,186	6,063

TGFβ1 gene expression after 16 hours of dryness and hyperosmolarity induction and recovery period. T-LYS showed significant lower expression compared to control treated with 0.9% Nacl (DRY) and Optive (OPT) groups. *P< 0.05; control HCE = 1

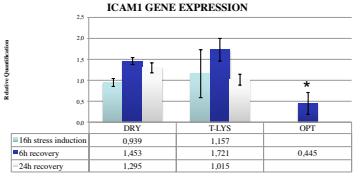
MMP1 GENE EXPRESSION



	DRY	T-LYS	OPT
16h stress induction	3,290	1,115	114,160
6h recovery	1,225	1,017	7,657
24h recovery	2,378	0,562	30,704

MMP1 gene expression after 16 hours of dryness and hyperosmolarity induction and recovery period. T-LYS showed significant lower expression compared to control treated with 0.9% Nacl (DRY) and Optive (OPT) groups. *P< 0.05; ** p<0.05 vs OPT control HCE = 1

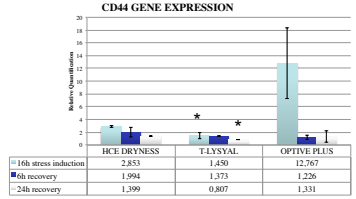
ICAM1 GENE EXPRESSION



	DRY	T-LYS	OPT
16h stress induction	0,939	1,157	
6h recovery	1,453	1,721	0,445
24h recovery	1,295	1,015	

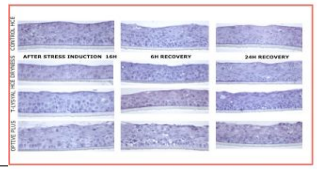
ICAM1 gene expression after 16 hours of dryness and hyperosmolarity induction and recovery period. Optive showed significant lower expression compared to control treated with 0.9% Nacl (DRY) and T-LYS groups. *P< 0.05; control HCE = 1

CD44 GENE EXPRESSION



	HCE DRYNESS	T-LYSYAL	OPTIVE PLUS
16h stress induction	2,853	1,450	12,767
6h recovery	1,994	1,373	1,226
24h recovery	1,399	0,807	1,331

CD44 gene expression after 16 hours of dryness and hyperosmolarity induction and recovery period. T-LYS showed significant lower expression compared to control treated with 0.9% Nacl (HCE DRYNESS) and Optive (OPT) groups. *P< 0.05; control HCE = 1



References

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[2] Gelardi M, Taliente S, Fiorella ML, et al. Intranasal T-LysYal as adjunctive therapy for patients after functional endoscopic sinus surgery. J Biol Regul Homeost Agents 2016;30:277-284.

[3] Barabino S, De Servi B, Aragona S, et al. Efficacy of a New Ocular Surface Modulator in Restoring Epithelial Changes in an in Vitro Model of Dry Eye Syndrome. Curr Eye Res 2016, in press.

[4] Meloni M, De Servi B, Marasco D, Del Prete S. Molecular mechanism of ocular surface damage: application to an in vitro dry eye model on human corneal epithelium. Molecular Vision 2011;17:113-126.