
IMMUNDX
by SEINDA
UNA LACRIMA.
CINQUE TEST.
Cinque biomarcatori.
Una visione più completa.
LTA
MUCIN / GOBLET CELL
MMP-9
INFIAMMAZIONE DELLA SUPERFICIE OCULARE
IgE
ALLERGIA
IL-8
RISPOSTA NEUTROFILA
IL-6
SEGNALE PRO-INFIAMMATORIO
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# How ImmunDx supports clinical practice

Clinical interpretation of tear biomarkers

SCINDA

i-ImmunDx™ Analyzer

OBJECTIVE • QUANTITATIVE • PoC



## i-ImmunDx Analyzer

A rapid point-of-care platform that quantifies tear biomarkers and supports differential assessment of dry eye, ocular allergy and ocular surface inflammation.

- **LTA** — Dry eye and mucin / goblet-cell function
- **IgE** — IgE-mediated ocular allergy
- **MMP-9** — Ocular surface inflammation

## LTA

Dry eye assessment

| ≤ 0.11 ng/mL | 0.11–0.55 ng/mL | 0.55–2.50 ng/mL | ≥ 2.50 ng/mL |
|---|---|---|---|
| **Severe mucin / goblet-cell deficiency** | **Mucin / goblet-cell deficiency** | **Reference range** | **Increased T-cell immune activity** |
| Support mucin secretion and ocular surface repair | Support tear-film stability and tissue repair | Manage according to symptoms and clinical findings | Assess inflammation and consider immunomodulation |

## IgE

Ocular allergy assessment

| < 1.0 IU/mL | 1.0–2.50 IU/mL | 2.5–22.08 IU/mL | > 22.08 IU/mL |
|---|---|---|---|
| **No significant elevation** | **Borderline / mildly elevated** | **Mild-to-moderate IgE allergy** | **Moderate-to-severe IgE allergy** |
| Consider dry eye, infection or non-IgE inflammation | Correlate with signs, symptoms and other findings | Consider antihistamine and/or mast-cell stabilizer | Reduce allergen exposure and consider added anti-inflammatory therapy |

## MMP-9

Inflammation

| < 38 ng/mL | 38–135 ng/mL | 135–358 ng/mL | > 358 ng/mL |
|---|---|---|---|
| **No significant elevation** | **Mild-to-moderate inflammation** | **Moderate-to-severe inflammation** | **Severe inflammation with epithelial damage** |
| Interpret with other biomarkers and clinical findings | Treat the cause and support ocular surface repair | Consider appropriate anti-inflammatory therapy | Identify the cause and support epithelial repair |

# Biomarker combinations

Clinical interpretation and management considerations

LTA IgE MMP-9

## IgE + LTA

Ocular allergy and dry eye phenotypes

| CONCENTRATION | CLINICAL INTERPRETATION | MANAGEMENT |
|---|---|---|
| IgE > 2.50 IU/mL<br>LTA > 2.50 ng/mL | **IgE allergy with increased T-cell immune activity** | Treat allergy. Assess need for anti-inflammatory or immunomodulatory therapy. |
| IgE > 2.50 IU/mL<br>LTA < 0.55 ng/mL | **IgE allergy with mucin / goblet-cell deficient dry eye** | Treat allergy and tear-film deficiency. Support mucin secretion and surface repair. |
| IgE < 1.0 IU/mL | **IgE allergy less likely** | Interpret with signs, symptoms and LTA to assess dry eye or other disease. |

## LTA + MMP-9

Dry eye phenotype and inflammation

| CONCENTRATION | CLINICAL INTERPRETATION | MANAGEMENT |
|---|---|---|
| LTA > 2.50 ng/mL<br>MMP-9 > 38 ng/mL | **T-cell activity with inflammation and epithelial damage** | Consider immunomodulatory and anti-inflammatory therapy. Support epithelial repair. |
| LTA < 0.55 ng/mL<br>MMP-9 > 38 ng/mL | **Mucin / goblet-cell deficient dry eye with inflammation** | Address inflammation while supporting mucin secretion, repair and tear-film stability. |
| LTA < 0.55 ng/mL<br>MMP-9 < 38 ng/mL | **Mucin / goblet-cell deficiency without significant MMP-9 elevation** | Promote mucin secretion, surface repair and tear-film stability. |

## IgE + MMP-9

Ocular allergy and inflammation

| CONCENTRATION | CLINICAL INTERPRETATION | MANAGEMENT |
|---|---|---|
| IgE > 2.50 IU/mL<br>MMP-9 > 38 ng/mL | **IgE allergy with surface inflammation and epithelial damage** | Treat allergy. Consider added anti-inflammatory therapy and epithelial repair. |
| IgE > 2.50 IU/mL<br>MMP-9 < 38 ng/mL | **IgE allergy without significant MMP-9 elevation** | Initiate appropriate anti-allergic therapy. |
| IgE < 2.50 IU/mL<br>MMP-9 > 38 ng/mL | **Surface inflammation without significant IgE elevation** | Evaluate dry eye, infection, irritation or other inflammatory disease. |
| IgE < 1.0 IU/mL<br>MMP-9 < 38 ng/mL | **No significant IgE or MMP-9 elevation** | Manage according to clinical findings and consider other etiologies. |

## IgE + LTA + MMP-9

Comprehensive ocular surface assessment

| CONCENTRATION | CLINICAL INTERPRETATION | MANAGEMENT |
|---|---|---|
| IgE > 2.50 IU/mL<br>LTA > 2.50 ng/mL<br>MMP-9 > 38 ng/mL | **IgE allergy with T-cell activity and concurrent inflammation** | Treat allergy and inflammation. Assess need for additional immunomodulatory therapy. |
| IgE > 2.50 IU/mL<br>LTA < 0.55 ng/mL<br>MMP-9 > 38 ng/mL | **IgE allergy with mucin / goblet-cell deficient dry eye and inflammation** | Treat allergy and inflammation. Address tear-film deficiency and support surface repair. |

# ImmunDx scientific publications

Tear biomarkers: LTA, IgE and MMP-9

**PEER-REVIEWED EVIDENCE**

01 **Recent Developments in Tear Fluid Biomarkers: An Expert Perspective on Clinical Translation**

Gijs M, Enríquez-de-Salamanca A, Hagan S, Grzybowski A, Versura P

Taylor & Francis, 2026

02 **Anti-inflammatory and dry eye benefits of accelerated epi-off corneal cross-linking in pediatric keratoconus with allergic ocular surface disease and elevated MMP-9**

Mazzotta C, Gagliano C, D'Esposito F, et al.

Eye and Vision. 2026;13(1):2

03 **Tear lymphotoxin-alpha deficiency is associated with conjunctival epitheliopathy in patients with dry eye disease**

Yang Y, Lin T, Gong L

The Ocular Surface. 2025;38:209–218

04 **Exploring the Diagnostic Utility of Tear IgE and Lid Wiper Epitheliopathy in Ocular Allergy Among Individuals with Hay Fever**

Thomas R, Azizoglu S, Suphioglu C, Mikhail E, Gokhale M

Int J Mol Sci. 2025;26(18):9116

05 **Correlations between tear lymphocytotoxin-α (LT-α) level and disease severity in adult keratoconus**

Qin X, Luo S, Fang X, et al.

Front Med. 2025;12:1591159

06 **Tear matrix metalloproteinases-9 and ocular surface parameters in diabetics: a cross-sectional study in Shenyang, China**

Qu Z, Pazo EE, Yang L, et al.

BMJ Open. 2025;15:e087530

07 **Inflammation due to ocular surface homeostasis imbalance caused by pterygia: tear lymphotoxin-alpha study and a literature review**

Fang X, Lan G, Lin Y, et al.

J Ophthalmic Inflamm Infect. 2024;14(1):28

08 **Evaluation of lymphotoxin-alpha in pterygium and diagnostic value in active and inactive pterygium states**

Lan G, Fang X, Zhong Y, et al.

Scientific Reports. 2024;14(1):1866

09 **Role of lymphotoxin alpha as a new molecular biomarker in revolutionizing tear diagnostic testing for dry eye disease**

Li CR

Int J Ophthalmol. 2023;16(11):1883–1889

10 **Exploration of efficacy and mechanism of 0.05% cyclosporine eye drops (II) monotherapy in allergic conjunctivitis-associated dry eye**

Jiao X, Qi Y, Gao N, Zhang C, Zhao S, Yang R

Eye. 2024;38(5):937–944

11 **Significantly reduced level of lymphotoxin-alpha in tears from dry eye patients with Sjögren's syndrome or other systemic immune disease detected with a Point-of-Care LTA test**

Huang JF, Li H, Li L, Xiao AY, Liao C, Li Y

IOVS. 2023;64(8):3946

12 **Management of inflammation in dry eye disease: Recommendations from a European panel of experts**

Messmer EM, Ahmad S, Benitez Del Castillo JM, et al.

Eur J Ophthalmol. 2023;33(3):1294–1307

13 **Effects of Diquafosol Sodium Ophthalmic Solution on Tear Film Matrix Metallopeptidase-9 and Corneal Nerve Density in Patients with Type 2 Diabetic Dry Eye**

Qin G, Chen J, Li L, et al.

J Ocul Pharmacol Ther. 2024;40(6):370–378

14 **Executive summary: Japanese guidelines for allergic conjunctival diseases 2021**

Miyazaki D, Fukushima A, Uchio E, et al.

Allergol Int. 2022;71(4):459–471

15 **Diagnosis, Management, and Treatment of Vernal Keratoconjunctivitis in Asia**

Mehta JS, Chen WL, Cheng ACK, et al.

Front Med. 2022;9:882240

16 **Total IgE in tears accurately reflects the severity and predicts the prognosis of seasonal allergic conjunctivitis**

Bao J, Tian L, Meng Y, et al.

Clin Transl Allergy. 2022;12(3):e12139

17 **Ophthalmic manifestations are associated with reduced tear lymphotoxin-α levels in chronic ocular graft-versus-host disease**

Ma J, Li C, Zhao Y, Shen Z, Hu B, Peng R, Hong J

BMC Ophthalmol. 2022;22(1):18