tearcheck® SMART SCREENING

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tearcheck® - SMART SCREENING

Introduction:

Dry eye syndrome is recognized as a growing public health problem and one of the most frequent reasons for seeking ophthalmological intervention. Various terms have been used to describe dry eye disease (DED), including keratoconjunctivitis sicca and, more recently, dysfunctional tear syndrome, suggesting that the name more accurately reflects pathophysiological changes. The definition of DED which includes etiology, pathophysiology and symptoms was recently improved in the light of new findings about the role of tear hyperosmolarity and ocular surface inflammation in dry eye and its effect on visual function. According to current knowledge dry eye can be defined as a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.

Dry eye is a condition that results in dryness of the conjunctiva and cornea due to decreased tear function of tear glands or rapid evaporation of tears. On the basis of these underlying pathologic processes dry eye disease could be classified as tear deficiency or hyposecretive dry eye which includes Sjogren's syndrome and non-Sjogren's tear deficiency and evaporative or hyperevaporative dry eye (Table 1). This classification often neglects patients with simultaneous occurrence of hyper evaporation and hypersecretion. [4]

Table 1. Classification of dry eye. [4]

Dry Eye			
Tear deficient (hyposecretive) – LGD		Evaporative (hyperevaporative) – MGD	
Sjogren's Syndrome	Non-Sjogren's Syndrome	Intrinsic	Extrinsic
Primary	Lacrimal disease / deficiency	Oil deficient	Topical drug preservatives
Secondary	Lacrimal obstruction	Lid related	Vitamin A deficiency
	Reflex block	Low blink rate	Contact lens related
			Ocular surface change
			Drug related

The term "**tear-deficient dry eye**" implies that this condition is caused by the lacrimal acinar destruction or dysfunction with reduced lacrimal tear secretion and volume. This in turn causes tear hyperosmolarity, since water evaporates from a reduced aqueous tear pool. Tear film hyperosmolarity causes hyperosmolarity of the ocular surface epithelial cells which stimulates a cascade of inflammatory events.

Aqueous-deficient dry eye has two major groupings: Sjogren's syndrome and non-Sjogren's syndrome dry eye. Sjogren's syndrome is an exocrinopathy in which the lacrimal and salivary glands as well as other organs are affected by autoimmune processes and can be divided into two subgroups: primary and secondary Sjogren's syndrome. Conversely non-Sjogren's syndrome is a form of tear deficient dry eye due to lacrimal dysfunction, where the systemic autoimmune characteristic of Sjogren's syndrome has been excluded. The most common form is age-related dry eye.

Evaporative dry eye may be intrinsic as a result of meibomian lipid deficiency, poor lid congruity and lid dynamics, low blink rate, and the effects of drug use. Extrinsic evaporative dry eye embraces those etiologies that increase evaporation including vitamin A deficiency, the action of toxic topical agents such as preservatives (benzalkonium chloride), and topical anesthesia. Patient wearing contact lenses is more prone to have dry eye symptoms. Disease of the exposed ocular surface including allergic eye disease may lead to destabilization of the tear film and add a dry eye component to the ocular surface.

Symptoms:

It is often incorrectly assumed that symptoms of dry eye are the main feature of this disease, whereas unfortunately they do not always correspond with diagnostic test results except in severe cases. The symptoms that patients describe are the same ocular sensations felt in other ocular surface disorders, namely, reports of a gritty, sandy foreign body sensation and visual disturbances. Visual complaints are highly prevalent among dry eye patients usually described as blurry vision that clears temporarily upon blinking. These transient changes, resulting from disrupted tear film in the central cornea, can be profound with marked drops in contrast sensitivity and visual acuity thereby affecting workplace productivity and vision-related quality of life.

Diagnostic Procedures:

The diagnosis of ocular surface disease is based on the patient's symptoms and medical history which should include questions about topical and systemic medications used and possible exposure to aggravating factors. Currently available diagnostic tests and external examinations are also indispensable for every practitioner in order to reach the decision on the most suitable treatment. Symptom questionnaires allow for rapid and efficient collection of relevant information and can facilitate diagnosis of ocular surface disorders. Questionnaires and dry eye index scores can be useful to detect the presence of dry eye and to evaluate the effect of therapeutic treatment. Several questionnaires are available. However, there is still no standardized dry eye disease questionnaire that is universally accepted. After patient's medical history is obtained and questionnaires administered, clinical examination of the anterior segment and objective tests are necessary to confirm the diagnosis of dry eye. [4]

tearcheck®
The new solution for smart Dry Eye analysis.

"Taking care of vision comfort is an exciting mission, knowing that more and more people are noticing a change in their visual comfort. The habits of modern life, with the intensive use of digital devices is only one of the reasons why eyes can feel dry and tired. The condition of Dry Eyes is affecting all generations, with a rapid increase in the younger generation. Dry Eye Disease became the second most common eye disease worldwide and has a strong impact on peoples' lives and visual comfort. The earlier Dry Eye cases are evaluated, the better Dry Eyes can be managed. The easier Dry Eye analysis can be done, the more frequently patients' eyes can be checked. The simpler it is to show patients the changes to their visual comfort, the easier it will be to provide working and lasting solutions to finally improve peoples' quality of life. The concept of tearcheck® was driven by the idea of creating a new standard for smart, reliable and efficient Dry Eye analysis, which allows to evaluate patients' visual comfort fast, easily and fully automatically. tearcheck® has been designed based on the latest technology. Be inspired by our innovation and discover the difference in daily Dry Eye Management." *Petra BRUCKMUELLER - CEO ESW vision*

Visionary technology
tearcheck® allows quick and easy examinations, as in total 9 exams can be done, which provide break-through Dry Eye analysis in less than 10 minutes, report included. Two high-resolution cameras inside provide perfect capture of images and videos. White, blue and infrared light are used to perform the different exams within a self-explaining process, guiding you through.

A patented new way to evaluate tear film stability on the whole cornea, by using a line mask, is provided by two exams, which are done within one recording (TFSE®/NIBUT). Also patented is the exam to evaluate the degree of inflammation on the ocular Surface (OSIE®).

- EYE FITNESS TEST: Questionnaire to provide an overview of the patient's eye fitness in everyday life
- NIBUT / TFSE® (Non-Invasive Breakup Time / Tear Film Stability Evaluation): Assesses the stability of the tear film
- EYE REDNESS: Displays the superficial blood vessels on the ocular surface
- ABORTIVE BLINKING / BLINK RATE: Detection of the structure of blinks to identify uncompleted ones
- MEIBOGRAPHY: Visualizes the Meibomian glands
- DEMODEX: Enlarged image capturing the base of the eyelashes to evaluate for signs of Demodex
- D-BUT: Dynamic Breakup Time (COMING NEXT)
- **OSIE®:** (Ocular Surface Inflammatory Evaluation) Detects areas on the ocular surface with increased inflammation risk
- TEAR MENISCUS: Calculates the tear meniscus height

Be inspired by the innovation
"… to create a disruptive product fully dedicated to Dry Eye syndrome and capable of constantly evolving, that was my intention behind developing tearcheck®." *Dr. Yves Vincent BROTTIER - Creator of tearcheck®* [2]

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9 exams for smart analysis

There are two kinds of patients with symptoms leading to DED risk factors and they can be diagnosed in two different ways, creating more efficacy in the dry eye analysis with tearcheck®.

First group (GRAPH 2) are patients with normal or mild symptoms, affecting their vision comfort and life. Analysis of this group is easy and requires only a few steps to discover the reasons and the pathology of the problems. Preventive treatment to improve Eye Fitness can help this group to decrease or totally relieve from symptoms.

Second group (GRAPH 3) is more affected, with moderate and severe symptoms, which may already affect their life. This group requires a different approach and care. Evidence of MGD, LGD or combinations are very frequent.

Objective tests with proposed steps can simplify the analysis and give answers for optimal treatment.

The following tearcheck® analysing (GRAPH 1) describes the easiest way to create the story behind the patient's symptoms and problems. It shows in an understandable way the sequence of needed exams and can be also shown to the patient to present a solution for the next recommended steps to follow with GRAPH 1 (normal / mild) or with GRAPH 3 (moderate / severe).

tearcheck® SMART SCREENING guide shall allow fast and effective screening as a solution for quick and smart analysis of Dry Eye.

GRAPH 1

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START

- **EYE FITNESS TEST**: Normal | Mild → left branch; Moderate | Severe → right branch

Left branch (Normal / Mild):

- **NIBUT TFSE®**: Normal | Mild — Moderate | Severe
- **EYE REDNESS**: Normal | Mild — Moderate | Severe (Moderate | Severe → MGD/Combination)
- NO MGD/LGD
- **ABORTIVE BLINKING BLINK RATE**: Normal | Mild — Moderate | Severe
- **MEIBOGRAPHY**: Normal | Mild — Moderate | Severe

Right branch (Moderate / Severe):

- **NIBUT TFSE®**: Normal | Mild — Moderate | Severe
- **EYE REDNESS**: Normal | Mild — Moderate | Severe
- **LGD / MGD Combination**: MGD/Combination — LGD/Combination

MGD/Combination:

- **ABORTIVE BLINKING BLINK RATE**: Normal | Mild — Moderate | Severe
- **MEIBOGRAPHY**: Normal | Mild — Moderate | Severe
- **DEMODEX**: Normal | Mild — Moderate | Severe

LGD/Combination:

- **MEIBOGRAPHY**: Normal | Mild — Moderate | Severe
- Fluorescein
- **OSIE®**: Normal | Mild — Moderate | Severe
- **TEAR MENISCUS**: Normal | Mild — Moderate | Severe

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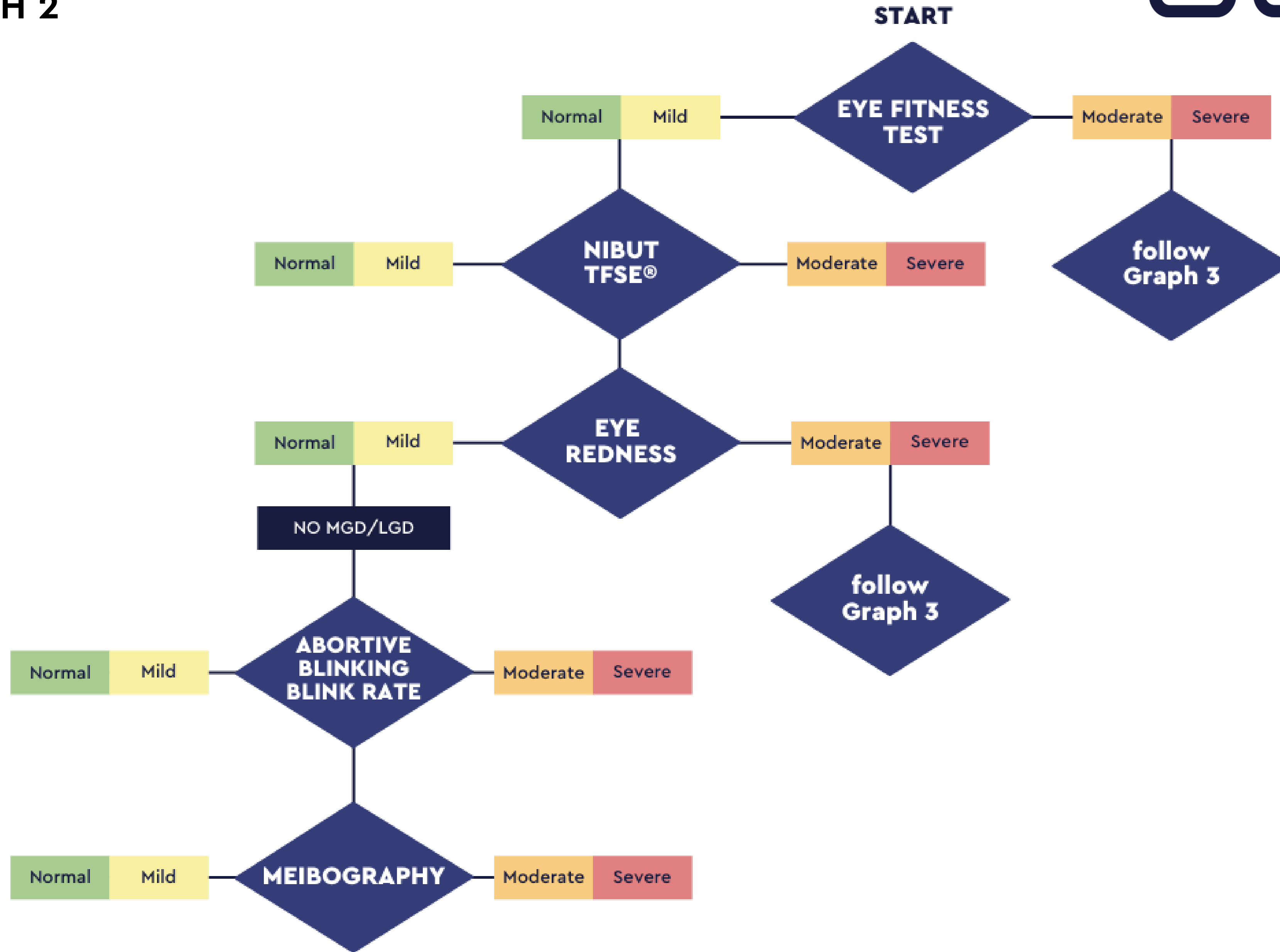
GRAPH 2 – NORMAL / MILD

1. Start with the subjective questionnaire **EYE FITNESS TEST** (sandy feeling, burning eyes, watery eyes, sensitive to wind or AC)
   - Mild symptoms are typical for people suffering from bad habits, allergy, bad blinking, little sleep, heavy use of screens, …
   - Depending on the result (normal / mild or moderate / severe) either further follow GRAPH 2 for normal / mild, or switch to GRAPH 3 for moderate / severe.
2. Next Step – **NIBUT/TFSE®** – classifies the quality of the tear film. Even people with normal eyes have sometimes moderate symptoms. Do not forget that Dry Eye is multifactorial.
   - To classify the symptoms in TSFE® and their reasons, we need to search for a further common and visible symptom – EYE REDNESS (inflammation).
3. **EYE REDNESS** – is classified by the CCLRU score. This score describes a level of visible inflammation in the ocular surface and in the lids.
   - In many cases, inflammation is first visible in the lids.
   - Even in a healthy ocular surface based on the CCLRU score, we may find symptoms in the lower lids. This may lead to inflammation of the Meibomian glands and finally to MGD and Ocular surface inflammation due to obstructed glands and bad production of the Meibom. **Posterior Blepharitis. - Inflamed Obstructive Meibomian Gland Dysfunction causes Ocular Surface Inflammation.**
4. Next step is **ABORTIVE BLINKING / BLINK RATE.**
   - To check for disorders, the influence of the blink rate and its effect to the secretion of oil from the Meibomian glands. **Aborted blinks** have direct impact on the quality of oil secretion. With low frequency of blinks or high frequency of aborted blinks the secretion is less due to not completed or few blinks. This affects the quality of the tear film and lubrication of the ocular surface.
   - For a healthy person it is recommended to practice the **eye fitness technique – 20/20/20** (take every 20 minutes a 20 second break for your eyes and look at an object that is about 20 feet away).
5. Last step is **MEIBOGRAPHY –** which allows the non-invasive evaluation of morphological abnormalities and quantification of Meibomian Gland loss. We believe and it is proven that good function can be restored even if more than 50% of your glands are lost.[7] Prevention can be always beneficial to support a good function.

GRAPH 2



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GRAPH 2 – NORMAL / MILD

tearcheck® SMART SCREENING
GRAPH 3 – MODERATE / SEVERE

1. Start with the subjective questionnaire **EYE FITNESS TEST** (sandy feeling, burning eyes, watery eyes, sensitive to wind or AC)
   - Moderate and Severe symptoms are already a sign of potential Dry Eye and it is important to pay attention in the next investigation.
2. Next Step – **NIBUT/TFSE®** – classifies the quality of the tear film.
   - With this measurement we can be able to identify the type of the dysfunction. If it is in 10% **tear deficient** (hyposecretive) – LGD or Evaporative (hyperevaporative) – **MGD** in 80%, or a **combination.**[6]
3. **EYE REDNESS** – is classified by the CCLRU score. This score describes a level of visible inflammation in the ocular surface and in the lids. In this case the symptoms may be visible in bulbar and parabulbar parts as well.
   - This may lead to inflammation of the Meibomian glands and finally to MGD and ocular surface inflammation due to obstructed glands and bad production of the Meibom. **Posterior blepharitis. - Inflamed Obstructive Meibomian Gland Dysfunction causes Ocular Surface Inflammation.**
4. Based on the graph of TFSE® and all other exams, we can now determine **LGD or MGD**.

FOR MGD OR COMBINATION

5. Next step in smart screening is **ABORTIVE BLINKING / BLINK RATE**.
   - To check for disorders, the influence of the blink rate and its effect to the secretion of oil from the Meibomian glands. **Aborted blinks** have direct impact on the quality of oil secretion. With low frequency of blinks or high frequency of aborted blinks the secretion is less due to not completed or few blinks. This affects the quality of the tear film and lubrication of the ocular surface.
   - **Eye fitness technique – 20/20/20 recommended for high frequency of aborted blinks. (if it's not Sjogren's syndrome)** (take every 20 minutes a 20 second break for your eyes and look at an object that is about 20 feet away)
6. **MEIBOGRAPHY** - which allows the non-invasive evaluation of morphological abnormalities and quantification of Meibomian Gland loss. We believe and it is proven that good function can be restored even if more than 50% of your glands are lost.[7] Prevention can be always beneficial to support a good function.
7. **DEMODEX –** presence of signs of DEMODEX - for risk population

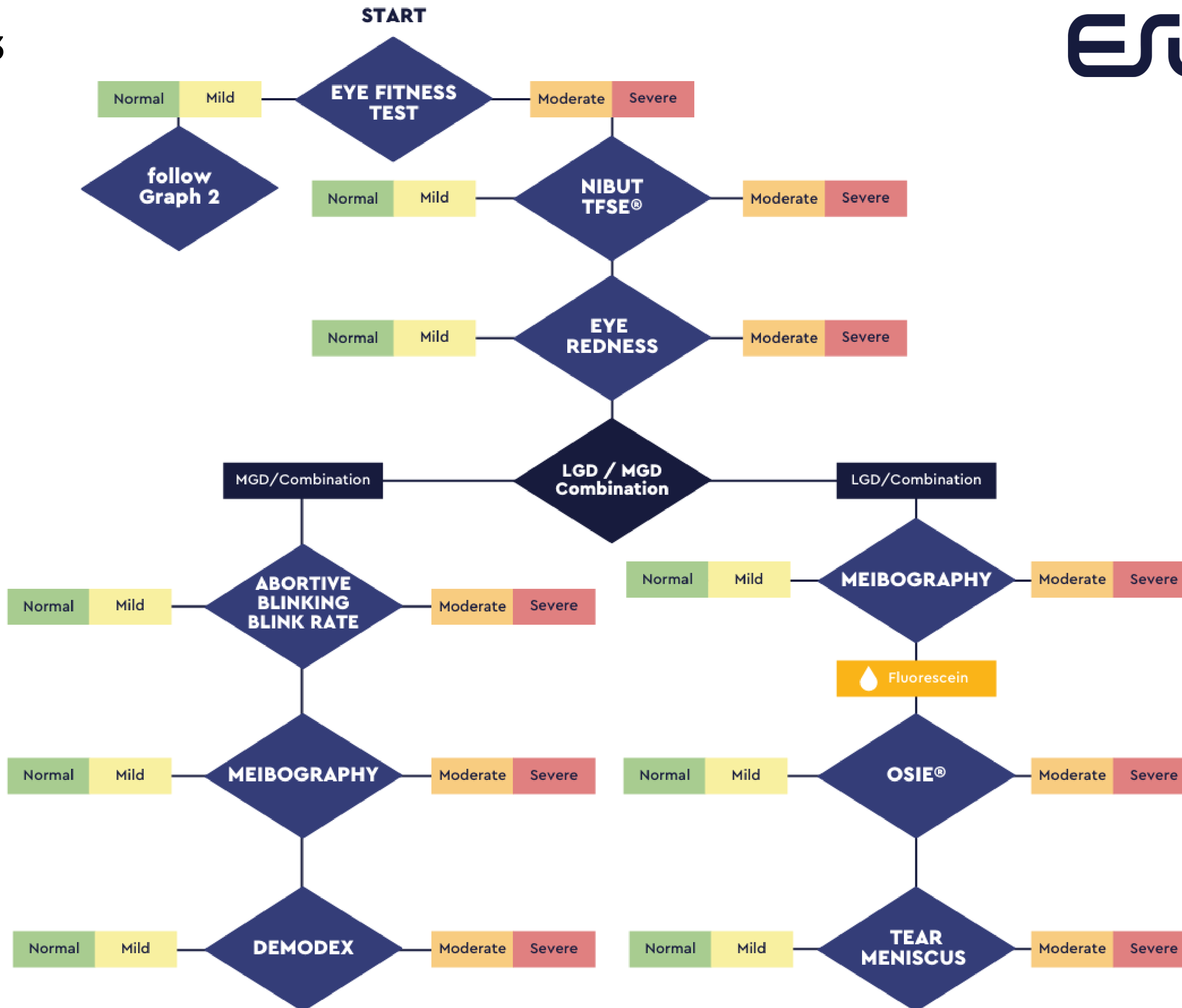
FOR LGD OR COMBINATION

5. For LGD type or combination – the next step is **MEIBOGRAPHY.**

<u>Next measurements - using a drop of Fluorescein.</u>

6. **OSIE® –** measures the percentage of selected area with high risk of inflammation and epithelium cell loss, which has direct impact on good visual outcomes.
7. **TEAR MENISCUS** – measures the production of tears / the level of tear film, determining by level high based on international score.

GRAPH 3



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GRAPH 3 – MODERATE / SEVERE

vision

CONCLUSION

The prevalence of DED is increasing with the rising number and extent of DED risk factors and its multifactorial etiology and frequent discordance between signs and symptoms. Various diagnostic tools and techniques are available, however, combining results from more than one test, in addition to signs and symptoms, can lead to a more dependable diagnosis, especially because no single test can measure all the factors involved in the pathophysiology of DED. tearcheck® is designed to provide smart and repeatable screening to help understanding the frequent discordance between signs and symptoms in a better and faster way.

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Smart Screening collected and created by
Peter BARANOVIC, MBA
International Commercial Director

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