

# The Effectiveness of Blinking Therapy in Dry Eye Disease among Workers: An Evidence-Based Case Report

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## Abstract

**Background:** Dry eye disease (DED) is a group of tear film disturbances that are caused by a decrease in tear production or tear film instability. One of the causes of DED is reduced tear secretion, which often happens in visual display terminal (VDT) workers. Blinking therapy is one of the therapies that can be given to DED workers to increase blink rate and reduce the number of incomplete blinks.

**Methods:** Literature searching was done on database such as Pubmed, Cochrane Library, and Google Scholar. The keywords used in the literature search were dry eye disease, blinking therapy, and ocular surface disease index. Three articles were chosen and critically appraised.

**Results:** Blinking therapy can be done using conventional methods, using animation software on a computer, or by using specifically designed wink glass. Blinking therapy showed statistically significant changes in OSDI scores, with therapy duration ranging from 20 minutes to 4 weeks.

**Conclusion:** Blinking therapy can be done as a treatment for DED workers to improve dry eye symptoms as measured in OSDI.

**Keywords:** blinking therapy, dry eye disease, ocular surface disease index (OSDI)

## Abstrak

**Latar Belakang:** *Dry eye disease* (DED) merupakan sekelompok gangguan pada lapisan tirai mata yang terjadi akibat penurunan produksi air mata atau instabilitas dari tirai mata. Salah satu penyebab terjadinya DED adalah penurunan sekresi air mata, yang sering terjadi pada pekerja *visual display terminal* (VDT). *Blinking therapy* merupakan salah satu terapi yang dapat diberikan pada penderita DED untuk meningkatkan *blink rate* dan menurunkan jumlah *incomplete blink*.

**Metode:** Pencarian literatur dilakukan pada database Pubmed, Cochrane Library, dan Google Scholar dengan kata kunci *dry eye disease*, *blinking therapy*, dan *ocular surface disease index*. Pencarian menghasilkan tiga artikel terpilih yang kemudian ditelaah kritis.

**Hasil:** *Blinking therapy* dapat dilakukan secara konvensional, menggunakan piranti lunak animasi pada komputer, ataupun menggunakan kacamata khusus *wink glass*. *Blinking therapy* dapat memberikan perubahan nilai OSDI yang signifikan secara statistik dalam jangka waktu terapi 20 menit hingga 4 minggu.

**Kesimpulan:** *Blinking therapy* dapat digunakan sebagai tata laksana pada pasien dengan DED untuk memperbaiki gejala mata kering sesuai dengan parameter yang dinilai pada OSDI.

**Kata Kunci:** *blinking therapy*, *dry eye disease*, *ocular surface disease index* (OSDI)

## Introduction

Dry eye disease (DED), or commonly called dry eyes, is a group of disturbances in the eye tear film caused by decreased tear production or tear film instability. DED is often related to uneasiness in the eyes, which may be accompanied by visual disturbances or inflammation in the ocular surface<sup>1</sup>. DED is commonly found in daily life, and its prevalence is estimated to be between 7-34% in the world. It is also estimated that one out of four patients that come to an ophthalmologist comes with dry eyes being the chief complaint.<sup>2</sup>

Computer Vision Syndrome (CVS) is another term used to describe DED, although these two terms are not exactly the same. CVS refers to a group of visual, ocular, and musculoskeletal (such as pain in the neck and shoulder) symptoms that occur due to prolonged computer usage<sup>3</sup>. Whereas in DED, other etiologies such as impairment in meibom gland, LASIK procedure, etc. may also cause dry eyes<sup>1,4</sup>. However, as it is practically difficult to differentiate the etiologies of DED, and most DED patients are usually computer users, these two terms are usually used interchangeably. The pathogenesis of CVS is caused by decreased tear production in the eye tear film, which may be caused by a decrease in the eye blinking reflex. This phenomenon often occurs during prolonged vision focused on a specific spot for a long time. The decrease in the eye blinking reflex then causes the tear film to dry up, while the produced tears also cannot cover the ocular surface properly, as the eyes blink less frequently.<sup>3,4</sup>

The symptoms that occur in CVS include ocular complaints such as uneasiness, redness, itchiness, pain, or dryness in the eyes<sup>3</sup>. Visual complaint such as double vision or blurriness in near vision, and musculoskeletal symptoms may also occur<sup>3</sup>. These symptoms, although they seem mild, may reduce the life quality and productivity of the patient, especially among workers. A national level study conducted in Korea in 2010-2012 shows that white collar workers have higher risk of suffering from CVS compared to other workers (OR 1.73 ; 95% CI, 1.73-1.41)<sup>5</sup>. Another study in Japan analyzed 672 workers using visual display terminal (VDT), and this study reveals a higher risk for women to suffer from DED, with the odds ratio (OR) being 2.00 (95% CI, 1.29-3.10). Workers older than 30 years old also have a higher risk of suffering from DED (OR 2.22 ; 95% CI, 1.06-4.66). Workers with

VDT usage duration exceeding 8 hours a day also have higher risk of suffering from DED (OR 1.94 ; 95% CI, 1.22-3.09)<sup>6</sup>. Another similar research which was also conducted in Japan, states that contact duration with computer screens for 4 hours or more may increase the risk of DED<sup>7</sup>.

The treatment for CVS requires artificial tears which should be given for a whole day. Education regarding sleep hygiene and working habits is also necessary<sup>1,4</sup>. Other research also recommends supplementation with omega-3 to help repair the function of tear film production. On the other hand, current research states that workers with DED have lower blink rates and higher numbers of incomplete blinks<sup>8</sup>. Incomplete blink is a blink in the eye that does not completely cover the ocular surface, which then causes some part of the ocular surface to be drier than its surrounding area<sup>6</sup>. Works that require a higher level of eye focus (such as working in front of computers) often cause a decrease in blink rate and an increase in the number of incomplete blinks, which then increase the risk of contracting DED. Therefore, DED workers need intervention to reduce the number of incomplete blinks and convert these incomplete blinks into complete blinks to stabilize the eye tear film. In this evidence-based case report, the authors present a case of CVS and will analyze the effectiveness of blinking therapy to relieve the symptoms in CVS.

The case illustration in this report describes a 42-year-old woman who came to the occupational clinic with pain and uneasiness in both eyes for 2 days prior to the clinic visit. Both eyes were also red, watery, and there were foreign object sensations in both eyes. There were no history of eye trauma or foreign object involvement. The worker also did not rub her eyes using her hands. This was her first time experiencing these kinds of symptoms. She has worked as an administrator for the general affairs division and human resource section in an oil and gas industry. During her daily routine, she has been working in front of a computer for at least 5 hours a day. The worker did mention that during the last 2 weeks, her workload increased due to new assignments, causing her to work longer for up to 7 hours a day in front of a computer screen. The worker wore glasses with the lens power being S-0.75, C-0.25, 900 axis for the right eye and S-0.75, C-0.50, 800 axis for the left eye.

The worker was then referred to an ophthalmologist. Clinical examination revealed there was no visual

impairment using the worker’s previous glasses. Visual field, pupillary reflex, and eyeball movement examinations also revealed no abnormality. Examination of the anterior segment of the eye showed conjunctival injection, chemosis, but no secrete was found. No abnormalities were found in the pupil, iris, lens, vitreous humor, retina, or other posterior segment of the eye. The worker was then diagnosed with DED and prescribed carboxymethylcellulose (an example of artificial tears)

for 4-5 times a day. Education about blinking therapy was also given, which was done by closing the eyes for several seconds, followed by opening the eyes, and closing the eyes again for several seconds. This cycle was repeated every 20 minutes while the worker was working in the office. From this case illustration, a clinical question needs to be answered: does blinking therapy relieve ocular symptoms in workers with dry eye disease?

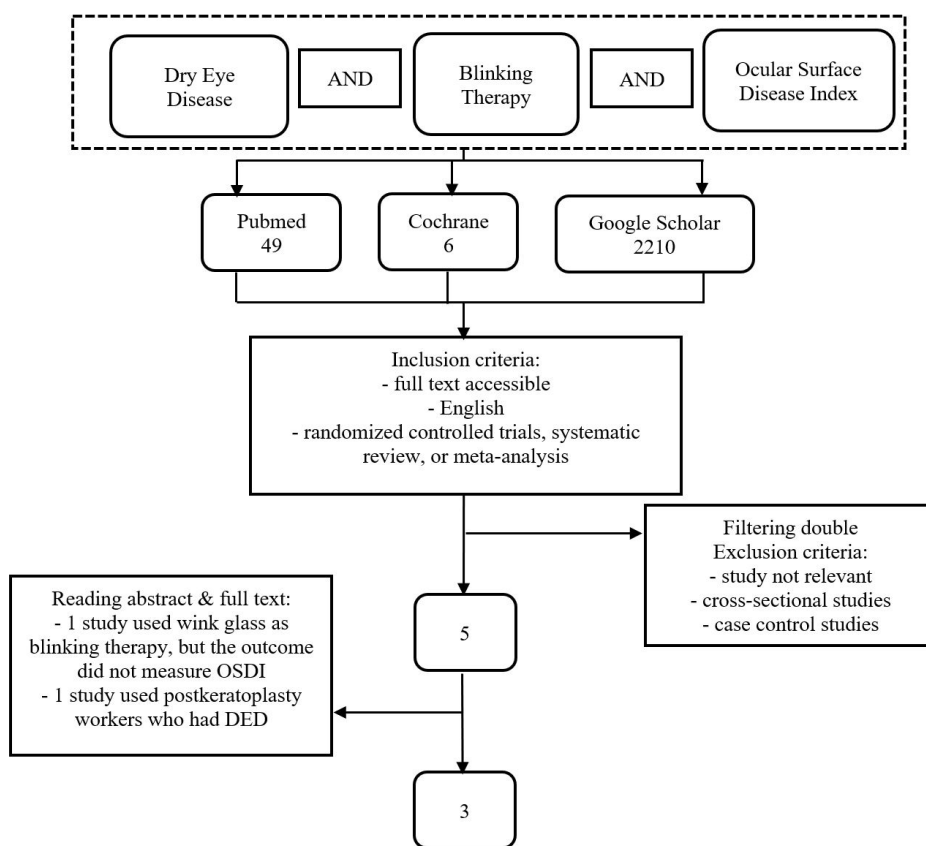


Figure 1. Searching Strategy Flow Diagram

Table 1. Searching Strategy (conducted at June 20<sup>th</sup>, 2020)

Database	Searching Strategy	Result
Pubmed	(((dry eye disease) OR (dry eye syndrome)) OR (dry eyes)) OR (computer vision syndrome) AND (((blinking therapy) OR (blinking exercise)) OR (blinking)) AND ((ocular surface disease index) OR (osdi))	49
Cochrane	“dry eye disease” in All Text AND blinking in All Text AND “Ocular Surface Disease Index”	6
Google Scholar	dry eye disease AND blinking AND ocular surface disease index	2210

## Methods

Literature searching was done using database such as Pubmed®, Cochrane Library®, Scopus®, and Google Scholar. Database searching was done on July 20th, 2020. To explore the effectiveness of blinking therapy, an instrument is needed as a parameter of symptom relief in DED workers. According to TFOS DEWS II (Tear Film and Ocular Surface Society International Dry Eye Workshop II) and American Academy of Ophthalmology, the instrument that is most often used is the ocular surface disease index (OSDI)<sup>1,10</sup>. OSDI quantifies the severity of symptoms in DED workers, consisting of 12 questions. Each question has its portion, which is then summed up and converted into a score ranging from 0-100 using a table provided in the questionnaire<sup>11</sup>. Higher OSDI score indicate more severe symptoms in workers. In this report, the author chooses OSDI as a parameter to monitor symptoms changes in DED workers.

Literature searching was done using these keywords: dry eye disease, blinking therapy, and ocular surface disease index. The literature searching diagram is summarized in Figure 1 and the literature searching keywords in each database are shown in Table 1. Inclusion criteria for searching result consist of accessible full text, available in English; the study being an RCT, systematic review, or meta-analysis. Filtering for double articles was also done. Irrelevant studies, cross-sectional studies, and case-control studies were excluded. From this strategy, 5 articles were then read thoroughly, and one of these articles did not show the outcome (OSDI) that was needed in this report, and thus it was excluded. One other study included post-keratoplasty workers in the samples, so it was also excluded from this report. Therefore, the searching strategy yielded 3 studies which were then critically appraised using Oxford Centre for Evidence Medicine criteria for therapeutic studies.

## Result

There were three chosen articles from the literature searching conducted in this report: Kim et al.<sup>11</sup>, Nosch et al.<sup>12</sup>, and Ang et al.<sup>13</sup>. Table 2 summarizes the design and characteristics of each study. These three articles were then critically appraised using Oxford Centre for Evidence Medicine criteria for therapeutic studies<sup>14</sup>.

Critical appraisal was done on validity, importance, and applicability aspects. The results of the critical appraisal can be seen in Table 3.

## Discussion

The three studies done by Kim et al., Nosch et al., and Ang et al. used the main principle of blinking therapy to reduce the number of incomplete blinks in DED workers. Nevertheless, each study used different methods of blinking therapy. Kim et al. used conventional blinking therapy, which was called “blinking exercise”. This blinking exercise was routinely done every 20 minutes during working hours for 4 weeks. It was done by closing the eyes for 2 seconds, followed by opening the eyes, then closing the eyes again for 2 seconds, and closing the eyes harder (called squeezing) for another 2 seconds. After that, the worker may open the eyes and one blinking exercise session is over. Whereas in the study done by Nosch et al., the blinking therapy was done with the help of a computer software using a “blink blink” animation which was installed on the workers’ computers. This software would give instructions to the research subjects to blink their eyes. Ang et al. used special glasses as a method of blinking therapy. These glasses, called “wink glass”, would automatically show a blurry image in the glasses if the sensor detected no eye blinking for 5 consecutive seconds.

Each of these methods has its own advantages and disadvantages. Wink glass appears to be the most comfortable method and easy to use, in addition to the fact that it can also be used outside of working hours. However, wink glass is much more expensive, not readily available to all DED workers, and it relies on battery power, which may run dry if used for a long time. Conventional method (blinking exercise) seems to be much simpler and can be done by everyone. But it requires workers’ cooperation and compliance, and thus the result of the therapy relies greatly on the worker’s willingness to follow the strict rules in blinking exercises. Whereas with wink glass, the worker will be forced to blink their eyes in order to lift the blurry effect displayed by the glasses. On the other hand, animation software can also give instructions for DED workers working in front of monitors to blink periodically, even though there is still a chance that the workers will refuse to blink.

All of the three studies used OSDI as a parameter to measure the effectiveness of blinking therapy, except

**Table 2.** Design and Characteristics of The Chosen Articles

Articles	Types of Research	Therapy Duration	Number of Samples	Strengths	Weaknesses
Kim, 2020	Prospective cohort	4 weeks	54	Intervention was given for quite a long time, and no specific equipment was needed.	Trial subjects might disobey the instructions given in blinking exercise, since there was no tight observation regarding the subject's compliance.
Nosch, 2015	RCT	1 week	24	The subjects were uniformly given the same instruction to blink their eyes in front of the computer screen.	Trial subjects might disobey the instructions to blink their eyes when the "blink blink" animation was played. Additional software was needed to be installed.
Ang, 2014	RCT	20 minutes	26	The study population was from Malaysia, which might be more similar with Indonesian workers' characteristics.	Trial duration was very short compared to other studies.

**Table 3.** Critical Appraisal of The Chosen Articles using Oxford Centre for Evidence Medicine Criteria<sup>14</sup>

Critical Appraisal	Kim, 2020	Nosch, 2015	Ang, 2014
<b>Validity Aspect</b>			
Was the assignment of workers to treatments randomized? And was the randomization list concealed?	All workers were given the same treatment, so randomization was not needed. This study used OSDI score as a comparison parameter from before and after therapy.	Randomization was not needed in this study. The control workers were given placebo treatment as a comparison.	Randomization was done to determine whether a subject was given placebo first or treatment first.
Were all workers who entered the trial accounted for at its conclusion? And were they analyzed in the groups to which they were randomized?	In the beginning of the research, there were 54 subjects. But by the end of the trial, only 41 subjects remained. However, this number still exceeded the minimum number of samples needed, which is 34 subjects.	All subjects participated from the beginning until the end of the research.	All subjects participated from the beginning until the end of the research.
Were workers and clinicians kept "blind" to which treatment was being received?	All subjects were given the same treatment, so blinding was not necessary.	The subjects were not aware nor notified whether they were given placebo or treatment during the research.	Blinding was not described in this study, so it was unknown whether blinding was done or not.
Aside from the experimental treatment, were the groups treated equally?	All subjects were treated equally aside from the experimental treatment.	All subjects were treated equally aside from the experimental treatment.	All subjects were treated equally aside from the experimental treatment.
Were the groups similar at the start of the trial?	In the beginning of the subject recruitment, the researchers determined that the subjects were at least 16 years old, diagnosed with DED based on OSDI or DEQ-5, no prior history of eye procedure, not using contact lenses, and not having any other systemic disease.	All trial subjects were office workers in the same office. The subjects all had at least 20/30 visual acuity, did not have prior history of eye procedure or other systemic disease.	All subjects had the same characteristics: being 19-34 years old, no history of other eye disease, and were not in use of any other medication.

Importance Aspect			
	In the first visit, the average OSDI score was 36 (+/- 18), and by the end of the trial, it became 22 (+/- 17), with p<0.001. This shows that there was significant DED severity reduction, from moderate to mild symptoms.	In the treatment group, there was decrease in OSDI score as much as 5.42 (+/- 2.86), while in the placebo group, the decrease was 1.79 (+/- 1.38), with p<0.001.	There was some modification done on the OSDI used, so that only the first five questions were used, which caused the maximum OSDI score to be 20 instead of 100. In the treatment group, the median OSDI score was lower, which was 0.67 (+/- 0.93). while the control group had higher OSDI score, which was 1.63 (+/- 1.79) with p=0.016.
Applicability Aspect			
Is your worker so different from those in the trial that its results can't help you?	The workers in this research had similar characteristics with the worker in this case illustration, who were all visual display terminal (VDT) office workers.	The workers in this research had similar characteristics with the worker in this case illustration, who were all visual display terminal (VDT) office workers.	The workers in this research had similar characteristics with the worker in this case illustration, who were all visual display terminal (VDT) office workers.
Are your worker's values and preferences satisfied by the regimen and its consequences?	The therapy does not have any problems with the workers' value or preferences, which make it a feasible treatment.	The therapy does not have any problems with the workers' value or preferences, which make it a feasible treatment.	The therapy requires a specific device (wink glass), which may not be widely available for all workers.

in the study by Ang et al., there was some modification in the OSDI that was used so that only the first five questions were accounted in the data analysis, which then caused the maximal OSDI score to be 20 instead of 100. From all of the three studies, similar results were seen: there were significant reductions in OSDI average scores after blinking therapy was applied. The difference in the amount of OSDI score reduction in each study may be caused by the different methods of blinking therapy that were used by each study. Kim et al. study was conducted for 4 weeks, Nosch et al. study was conducted for a week, while Ang et al. study was only done for one session, which lasted for only 20 minutes. In Kim's study, the OSDI average score before therapy was 36 (+/- 18), while the average score by the end of the research was 22 (+/- 17), with p<0.001. If we compare this score in the table provided in the OSDI questionnaire, it shows that there was a significant decrease in degree of dry eyes severity from moderate to mild. While in the study by Nosch et al., the decrease in OSDI score was 5.42 (+/- 2.86) compared with 1.79 (+/- 1.38) in the placebo group, with p<0.001. OSDI score reduction was also found in a study by Ang et al. In the group using wink glass, the median OSDI score was lower (0.67 +/- 0.93) compared with control group

(1.63 +/- 1.79), with p=0.016. Therefore, it can be concluded that all three studies gave consistent results regarding the fact that blinking therapy can relieve DED symptoms observed from scoring by using OSDI.

If we go back to the case illustration provided in the introduction of this report, a career woman came to an occupational clinic with DED symptoms that had persisted for 2 days. The worker was already given artificial tears. However, because the interaction of office workers with computer screens is unavoidable, these workers are at high risk of suffering from DED even after the initial therapy has been completed. Therefore, blinking therapy could be given to this worker, in the hope that it could also prevent DED from recurring again in this worker in the future. By doing blinking therapy, the number of incomplete blinks could be reduced and the blink rate could be increased. From the applicability aspect, the conventional blinking exercise seems to be the more feasible choice, followed by the "blink-blink" computer software made by Nosch et al. study. Wink glass seems convenient, but it is not yet widely available in every place, and there is also the cost factor to be considered. Nevertheless, the combination of all of these methods can be applied simultaneously, whenever possible, to achieve the best result in the work.

## Conclusion

Based on the literature searching and critical appraisal that has been carried out by this report, it can be concluded that blinking therapy can be used in DED workers to relieve DED symptoms, which can be measured objectively using OSDI score. Several methods are available for blinking therapy, which include using conventional blinking exercise, software which is installed on a worker's computer, or using more advanced wink glass. Blinking therapy in general works by increasing the eyes blink rate and reducing the number of incomplete blinks, so that there will be relief of DED symptoms.

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