Agreement in dry eye management between optometrists and general practitioners in primary health care in the Netherlands

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ABSTRACT

Purpose: To investigate the agreement in dry eye care management between General Practitioners (GPs) and Optometrists in the Netherlands.

Methods: A web-based survey was used to investigate the agreement in symptoms associated with dry eye, causes of developing dry eye, and investigative techniques used in practice, between GPs and optometrists. Additional questions surveyed knowledge of the latest research, and co-management of dry eye disease in primary healthcare. The anonymised questionnaire contained 16 forced-choice questions with Likert scales, and was sent to 1471 general medical practitioners and 870 registered optometrists. The response data was stored on an online database, and was converted directly to text format for analysis using SPSS 21 statistical analysis software.

Results: 138 optometrists and 93 GPs responded to the survey (Cronbach α = 0.885, optometrists, and 0.833, GPs). Almost no agreement was found for all the questions: a statistically significant difference (Chi-square p<0.0001) was found between the optometrists and GPs in the use of investigative techniques, associating symptoms, causes of dry eye (p>0.0001), and dry eye symptoms, except for ‘burning sensation of the eye’ and ‘irritation of the eye’ as agreed symptoms, and agreement that dry eye is an age-related disease.

Conclusions: As the optometrist and the GP are the gatekeepers for secondary healthcare, the fundamental differences in the methods of investigation and interpretation of dry eye-related symptoms, the possible cause of developing dry eye disease, and the therapy given by GPs and optometrists in the Netherlands, may have a significant impact on consistency of patient care.
Introduction

Dry eye disease (DED) is a multi-factorial chronic ocular disease, with significant impact on visual functioning and daily life. This highly symptomatic, chronic condition is experienced by patients in a variety of symptoms that range from ocular discomfort to pain, from an impaired visual performance to photophobia, and so careful questioning is important for good diagnosis [1]-[4]. The multi-factorial nature of DED makes it difficult to define in one symptom or by any single current investigative technique, and, most importantly, no single treatment works for all. Moreover, because of the multi-factorial origin of the disease, patient reported symptoms and diagnostic tests have poor correlation [5]-[8].

DED is described as a chronic disease, as acknowledged by both the Dry Eye Workshop Report (DEWS) and the Meibomian Gland Dysfunction Workshop (MGDW) Report. Both reports give guidelines on appropriate questioning, investigation and treatment of dry eye disease [5], [9]-[11].

Estimates for the worldwide prevalence of DED give a range from as low as 0.1% to as high as 33% [5]. In the Netherlands there is no prevalence data available, partly due to a lack of consensus in defining DED. However, by using indirect measurements, an estimate of the prevalence of the disease can be made. In 2013 there were 573,540 users (out of a population of 17 million) in the Netherlands of prescribed artificial tears products, as reported from the data bank of the Drug Information System of National Health Care Institute (GIP 2013). This does not take into account the number of non-prescribed artificial tears advised or patient self-management. Optometrists in the Netherlands can prescribe, and advise on, over-the-counter artificial tears available on the Dutch market, and patients can self-manage using over-the-counter artificial tears sold by pharmacists and drugstores. The prescription of artificial tears, which is often an inappropriate and ineffective treatment, costs in excess of 26 million euros in 2013, an increase of 35% since 2009 (GIP 2013). Prescribed artificial tears and related products are ranked at 29 of the top 100 medicines that cost the most for the health system, as calculated by the Dutch drug information system (GIP 2013). The number of users of artificial tears and related products is ranked at 19 out of the 100 most prescribed medicines (GIP 2013).

The healthcare system in the Netherlands relies on triage of patients within the primary healthcare level, especially by the GP for treatment and referrals. The GP is said to be the
gatekeeper for secondary healthcare [12]. In the Netherlands, optometrists also have a role as a gatekeeper for referrals to ophthalmology. However, difficulties arise in the definition used in primary care for dry eye disease and no distinct criteria are available across primary healthcare in the Netherlands. This problem of definition used and examination done is investigated in several studies elsewhere and all describe wide variations among eye care practitioners and their scope of practice [3], [9], [13], [14]

In 2014, approximately 980 optometrists are registered with the Dutch Optometric Association (Optometrie Vereniging Nederland (OVN)). The total number of optometrists working in the Netherlands is unclear, but the OVN estimate that 90% of all optometrists are members, with approximately 70% of members working in primary healthcare. With a population of approximately 17 million, the number of optometrists in the Netherlands is low compared to the UK, where there are approximately 13,500 optometrists for a population of 63.5 million. The total number of GPs working in the Netherlands in 2011 was estimated to be approximately 8800 [15].

The data collected from a survey undertaken by the OVN [9] (about the tasks and duties in diagnosing and treating red eye and tear film/dry eye-related disease in primary care) showed a strong opinion by ophthalmologists for letting the GP take charge in the investigation, diagnosis and treatment rather than the optometrist. However, this opinion was made without having a good overview of the impact of DED in primary care and the knowledge, equipment and skills of the optometrist in managing DED. It could be argued that, with the multi-factorial and chronic nature of dry eye disease and the possible environmental influences, the optometrist should be the first practitioner in the line of care.

In the literature, to our knowledge, there are no reports comparing the diagnosis and management of DED between GPs and optometrists. In contrast, the literature shows a generally good agreement in diagnosis and management between ophthalmologists and optometrists who have similar levels of education [16], [17].

The aim of this study is to investigate and determine the agreement between optometrists and GPs in relation to subjective dry eye symptoms, the causes of developing dry eye, the use of investigative techniques, and the treatment options used.
Methods

Using a cross-sectional design using a web-based questionnaire was developed to survey knowledge, investigative methods and therapy preference for patients with dry eye disease, using forced-choice questions and Likert scales.

Survey Design

An initial survey was designed, and a pilot study of 14 questions was sent by email to 12 optometrists and 12 GPs who had some involvement in local initiatives for co-management, and had access to the internet. The questionnaire was hosted on the surveymonkey.com website, with password restricted access to the data. The access time for completing the survey was one month and one reminder was sent after 2 weeks. Eleven optometrists and five GPs completed the survey. The responses from these participants were not included in the main study. With feedback from this pilot study, a final version of the questionnaire was developed, consisting of 10 main questions (Table 1), which surveyed the knowledge, investigative methods and therapy preference for dry eye disease. The survey was designed in English, and translated into Dutch when used.
Questions 1 and 2 asked for estimates of patients seen
1. How many patients do you see per week and how many dry eye patients do you see per week?
2. Can you give an estimation of the average age of patients in your practice with dry eye problems, divided according to those not wearing contact lenses and those wearing soft contact lenses?

Question 3 asked for the use of specific dry eye questionnaires and was answered from 3 choices: OSDI, McMonnies, and personally designed dry eye questionnaire.

3. To aid diagnostics, do you use a dry eye questionnaire?

The following questions were forced-choice

Question 4 was answered by Likert scales with five choices; not specific, sporadically, occasionally, most frequently, always
4. Which of the following symptoms do you specifically associate with dry eye?

Questions 5-8 were answered by Likert scales with five choices; never, sporadically, occasionally, most frequently, always
5. Which of the following possible causes of dry eye do you see in your practice?
6. Which of the following investigative techniques do you use to diagnose dry eye?
7. Which of the following is the reason of development of dry eye in your patients?
8. What is the most commonly used/prescribed treatment after your diagnosis of dry eye?

Question 9 was answered by forced-choice on a Likert scale with three choices: No, I do not know these investigations, Yes, but never read it in detail, Yes, have read some or have detailed knowledge of the articles.
9. Are you aware of the most recent large scale research reports of dry eye, such as the Dry Eye Workshop (DEWS) or Meibomian Gland Disease (MGD) workshop?

Question 9 was answered by forced choice, yes or no

10. Are you working together with an optometrist or GP (co-management) in your area specifically for dry eye management?

Table 1: Survey questions investigating knowledge, investigative methods, therapy preference and experience of GPs and optometrists.

Recruitment
Optometrists: An invitation email with details of the internet link to the survey was sent to all optometrists registered with the OVN (Optometrie Vereniging Nederland, n = 870). Access to the survey was permitted from November 2012 to March 2013. In the invitation, participants were asked to fill in the survey if they were working mainly in primary healthcare, since the scope of practice for an optometrist working in secondary (in ophthalmology offices) or tertiary healthcare (low vision or therapeutic lenses) will be different if they are working in direct consultation with an ophthalmologist, and have access to therapeutics (directly or indirectly) prescribed by ophthalmologist. The patients they see
may also differ in severity and co-morbidity of eye diseases to those more commonly seen in primary care practice. According to the OVN, 70% of Dutch optometrists work in primary healthcare, giving a total cohort size of 609 subjects.

GPs: Paper copies of the survey, along with details of the internet link to the survey and an invitation to participate in the study, were sent by general mail to the 224 offices of the HAP (HuisArtsen Post) in the Netherlands. (HAP is the main out-of-hours GP Service in the Netherlands). The survey was sent between November 2012 and January 2013. A direct email invitation, with details of the internet link, was also sent to 1471 email addresses collected from an open access internet site for internship placements for GPs. The GPs were selected from each province of the Netherlands working in primary healthcare, and the email invitation was sent from February 2013 to July 2013.

Ethical approval
For ethical approval, each English version was translated into Dutch and screened by a native English-speaking Dutch optometrist and colleague at the Hogeschool Utrecht, and then translated back to English. Only the final questionnaire was sent to the Ethics Committee. The study was approved by the Research Ethics Audit Committee of the School of Optometry and Vision Sciences at Cardiff University and was consistent with the tenets of the Declaration of Helsinki. Access to the survey was secured using a login code and password. Only the researcher had access to the data. The data was stored on an online database, and was converted directly to text format for analysis using the SPSS 12.1 statistical analysis software program.

Statistical methods and analysis variables
Cronbach’s alpha, a coefficient of consistency, was used to measure internal consistency of the questions per group. Descriptive statistics were used to describe the demographic data for the first two survey questions using median, means and standard deviations. A Pearson’s Chi-square test was used to compare differences in given answers among the GPs and Optometrists. A p-value of less then 0.05 was considered to denote statistical significance. Frequency tables were constructed for both GPs and optometrists for each question to provide an overview of the responses given. The Kendall W test (or Kendall’s coefficient of concordance for ranks) was used to value the agreement amongst GPs and optometrists, with zero indicating no agreement and one indicating complete agreement.
Results

Optometrists: Of the 861 emails sent by the OVN, 25 were returned with a wrong or not usable email address, or from a full inbox. Of the 836 optometrists reached, 138 responded, giving a response rate of 16.3%. Based on a possible primary healthcare cohort of 609 then the response rate for that cohort sub-group would be closer to 22%.

GPs: Of the 1471 GP email addresses, 81 rejected the email and 59 emails bounced. In total, 1331 GPs were reached by email and of those a total of 93 GPs completed the survey, to give a response rate of 7%. Of the 93 completed surveys, 77 GPs used the direct access link to the survey, 14 responded indirectly by going online to the survey website, and 2 sent a completed print version by regular post.

The survey results for each subject cohort showed good internal consistency, with a Cronbach alpha coefficient reported of 0.833 for the GPs and 0.885 for the optometrists.

Patient demographics

A comparison of the median number of general patients seen per week by optometrists and GPs shows that the number for the GPs is almost double that for the optometrists: the median patients seen per week by the GP was 105 and by optometrist was nearly 42 (41.97). However, while the estimated number of dry eye patients seen per week was approximately 2 (1.78) patients per week for the GP, it was almost 14 patients per week for the optometrist (Table 2).

The estimated average age of dry eye patients seen without soft contact lens wear was significantly different between the GPs (nearly 61 years) and the optometrists (nearly 56 years) (p=0.011), although still of a similar age. Likewise, the average age of the patients with dry eyes and wearing soft contact lenses was significantly different, with GPs at almost 39 (38.57) years and for optometrists at 40 years of age (p=0.03), but this was not clinically significant (Table 2).

Use of Dry Eye Questionnaire

Analysing this question with the Pearson chi-square showed no statistical significant difference between optometrists and GPs for the use of either the OSDI (p=0.147) or McMonnies (p=0.403) questionnaires. A significant difference was found for the use of a
personalised questionnaire (p<0.01), with the optometrist more frequently using personalised questionnaires (40% of the optometrists vs none of the GPs).

<table>
<thead>
<tr>
<th></th>
<th>Median number of patients seen per week</th>
<th>Average number of dry eye patients seen per week</th>
<th>Average age dry eye patients not wearing soft contact lenses</th>
<th>Average age dry eye patients wearing soft contact lenses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GPs</strong></td>
<td>n=87</td>
<td>n=86</td>
<td>n=71</td>
<td>n=45</td>
</tr>
<tr>
<td></td>
<td>105 patients</td>
<td>78 patients</td>
<td>61.41 years</td>
<td>38.57 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sd 1.77</td>
<td>sd=9.5</td>
<td>sd=10.5</td>
</tr>
<tr>
<td><strong>Optometrists</strong></td>
<td>n=136</td>
<td>n=110</td>
<td>n=88</td>
<td>n=85</td>
</tr>
<tr>
<td></td>
<td>41.97 patients</td>
<td>13.94 patients</td>
<td>55.9 years</td>
<td>40 years</td>
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<td></td>
<td></td>
<td>sd=11.85</td>
<td>sd=9.47</td>
<td>sd=7.79</td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>P&gt;0.00</td>
<td>P&gt;0.00</td>
<td>P=0.03</td>
<td>P=0.011</td>
</tr>
</tbody>
</table>

Table 2: Demographic data patients seen per week (n = number of participants completing the question).

Symptoms for dry eye

A statistically significant difference (p<0.0001) was found between optometrists and GPs, in judging which patient symptoms they specifically associated with dry eye, for: itching of the eye, transient vision changes, sticky eyelids in the morning, pain sensation in the eye, pain around the eye, photophobia, eyelid hyperaemia, bulbar conjunctiva hyperaemia, skin disease (e.g. acne rosacea), and asthenopia. For these symptoms, GPs were less likely to link them with dry eye. However, for the symptoms of ‘burning sensation of the eye’ and ‘irritation of the eye’ (p=0.073 and p=0.298, respectively) there was closer agreement for both practitioners that these symptoms are an indication for dry eye.

Using Kendall’s W coefficient to assess the consistency of agreement within the optometrists across the symptoms, a coefficient of 0.291 was found, indicating only a small level of agreement. A similarly low coefficient of 0.390 was found for the results of the GPs.

The mean rank of all symptoms showed that burning sensation of the eye, irritation of the eye and tearing of the eye were ranked highest by the GPs, while for the optometrist the
mean ranked top three were burning sensation, tearing, and irritation of the eye. The frequency tables for the survey answers are given graphically in Figures 1 and 2.

Figure 1: Percentage agreement for dry eye symptoms indicated by optometrists

![Dry eye symptoms indicated by optometrists](image-url)
Causes of dry eye disease

Of the possible causes for dry eye in patients attending their practice, no significant difference in expectation was found between GPs and optometrists when diagnosing dry eye as an age-related disease. For all other possible causes: medication use (p<0.001), auto-immune (p<0.004), allergy-related (p<0.0001), inflammation (p<0.0001), work-related (p<0.0001), contact lens use-related (p<0.0001), and hormonal-related (p<0.0001), there was a statistically significant lack of agreement between the optometrists and GPs. In general, the optometrists showed more variance in describing the causes of dry eye.

Optometrists indicated work-related (highest score), age-related and hormonal-related causes as the main reasons for developing dry eye. The highest mean ranking for the GPs was age-related, then work-related causes and contact lens use. The Kendall W coefficient shows some concordance (0.311) for optometrists, with GPs showing a slightly lower concordance (0.304) (Figures 3 and 4).
Reasons for developing dry eye

The frequency tables of reasons for developing dry eye reported by optometrists showed a tendency towards Meibomian Gland Dysfunction (MGD), with MGD showing the highest mean ranking, followed by anterior blepharitis and soft contact lens wear. There was a low
agreement for this question among optometrists (Kendall’s W concordance 0.178) (Figures 5 and 6).

The highest mean rank for the GPs was tear deficiency, followed by soft contact lens wear and RGP (rigid gas permeable) wear. The overall agreement between the GPs was higher than the optometrists, but still low in general (0.313).

Figure 5: Percentage agreement in reason for developing dry eye indicated by optometrists
NOMGD: Not obvious meibomian gland dysfunction; MGD: Meibomian gland dysfunction;
Soft cl use: Soft contact lens use; RGP: Rigid gas permeable
Figure 6: Percentage agreement in reason for developing dry eye indicated by GPs

NOMGD: Not obvious meibomian gland dysfunction; MGD: Meibomian gland dysfunction;
Soft cl use: Soft contact lens use; RGP; Rigid gas permeable

Use of investigative techniques

No agreement was found between GPs and optometrists on the use of investigative techniques for dry eye diagnosis (p<0.001, Chi–square test). While Figure 7 shows that the optometrists use a variety of tests, Figure 8 shows that the GPs rarely use any of the diagnostic tests. The top three mean ranked diagnostic test by the optometrists were tear break-up time (BUT), lissamine green staining and fluorescein staining, and for the GPs, were lissamine green staining, osmolarity measurement and BUT testing. As for osmolarity measurements, out of the 87 GPs who answered this question, only 2 answered ‘always’ (2.3%), 3 answered ‘most frequent’ (3.4%), and 59 (67.8%) answered ‘never’. Of all the other tests, the percentage of ‘never using the test’ dominated the outcome strongly. The Kendall’s W test agreement for diagnostic test use by the GPs was 0.425, compared to 0.504 for the optometrists.
Figure 7: Percentage agreement for use of investigative technique, indicated by optometrists. LIPCOF: Lid parallel conjunctival folds; NIBUT: Non-invasive break-up time; BUT: Break-up time.

Figure 8: Percentage agreement for use of investigative technique, indicated by GPs. LIPCOF: Lid parallel conjunctival folds; NIBUT: Non-invasive break-up time; BUT: Break-up time.
The most commonly used treatment of dry eye after diagnosis was investigated to discover habitual treatment methods. A statistically significant difference was found between the GPs and optometrists for preserved artificial tears, unpreserved artificial tears, heat therapy, eyelid hygiene and punctum plugs (p<0.000*), except for gel/ointment (p=0.764) (Figures 9 and 10).

Figure 9: Prescribed treatment by optometrists, AT=Artificial tears
Knowledge of recent research of dry eye disease

When specifically asked about their knowledge of the Dry Eye Workshop Report (DEWS) and the Meibomian Gland Disease Workshop Report (MGDW), there was a statistically significant difference between the GPs and optometrists ($p=0.010$). The GPs had no knowledge of either the DEWS or MGDW report (Figures 11 and 12), and while the optometrists showed more awareness of both reports, they had a weakness in detailed knowledge.
Figure 11: Percentage agreement for knowledge of the DEWS report indicated by GPs and optometrists.

Figure 12: Percentage agreement for knowledge of the MGD Workshop report indicated by GPs and optometrists.
Both optometrists (91.8%) and GPs (98.8%) reported that they did not frequently work together in the co-management of dry eye patients.

Discussion
This survey has generated a better understanding of the daily practice of optometrists and GPs in the diagnosis and management of patients with dry eye disease in the Netherlands. Prior to this survey no information was available on the attitude and method of care delivery for patients suffering from dry eye in the Netherlands when seen by optometrists or GPs. Indeed, to our knowledge, no research has been published that compares these two primary healthcare practitioners in the management of DED. There are several important findings that arise from the survey which have implications for future development of clinical care guidelines for the management of DED in the Netherlands. These findings also have relevance to primary healthcare clinical practice elsewhere.

The survey found significant differences between GPs and optometrists in the number of
patients seen during a working week. Although some responses indicated having over 500 patient contacts per week, which seems excessive and may suggest a mis-understanding of the question, the relative differences between GPs and optometrists are clear. The median number of patients seen by the GPs during a week was 105 patients, and the median for the optometrist was 42. However, the number of dry eye patients seen per week was higher for the optometrist than for the GP: the GP saw on average 1.78 patients with dry eye symptoms, while the optometrist saw almost 14 patients a week. This latter difference may be because patients are more likely to report dry eye to an optometrist, or that the optometrist is more likely to ask about symptoms. The finding that the optometrist considers a wider variety of symptoms when making their diagnosis supports this perspective. Interestingly, the GPs results show a small standard deviation (1.77) compared to the optometrists (11.84) in dry eye patients seen. The small GP standard deviation suggests that seeing fewer dry eye patients is a consistent experience, whereas the greater variation for the optometrist might reflect the variety in the scope of practice for optometrists, some of whom might be working in a contact lens practice.

Despite a statistical difference, the similarity in patient age with dry eye symptoms without contact lens wear by both GPs (nearly 61 years) and optometrists (nearly 56 years) reflects one of the fundamental characteristics of dry eye disease – that its incidence is age-related. One of the best-known risk factors for developing dry eye is that it is more commonly found in patients aged 40 years and above [1]-[8], [18]. The GPs and the optometrists were also similar on a younger average age, of 40 years, for soft contact lens wearers attending with dry eye symptoms. This is consistent with the latest findings in the Contact Lens Discomfort Workshop Report (CLDW) that contact lens wearers, compared to dry eye patients, experience more dry eye-related problems at a younger age [5], [9]-[11], [19]. Indeed, the first reporting of dryness symptoms during contact lens wear is typically around 20-30 years of age [5], [20], and research shows that contact lens wear in a younger age population is a risk factor for ocular surface dryness-related problems [12], [21].

It is difficult to determine the real number of patients seen by both GPs and optometrists who have dry eye, but are not recognised as such. Generally, symptom questionnaires show the highest sensitivity and specificity for dry eye diagnosis supported with diagnostic tests [3], [9], [13], [14], [22]. In this investigation no specific questionnaire was used for DED, and the optometrists often used personally designed questionnaires. This lack of uniformity
could cause problems in communication between optometrists and GPs. The difference in diagnostic approach between GPs and optometrists may be observed through the symptoms that they each recognise as being specific for dry eyes, with only *burning sensation* and *irritation of the eye* seen by both as a specific symptom for dry eye. The use of the other symptoms was statistically significantly different. Interestingly, there was a wider spread of symptoms recognised by the optometrists, who agreed less with each other than did the GPs, who had a shorter list of diagnostic symptoms. This might be accentuated if the survey responses for optometrists came from those in more specialised practice versus more general practice optometrists.

The frequency tables of reasons for developing dry eye reported by optometrists showed a tendency towards Meibomian Gland Dysfunction (MGD), with MGD showing the highest mean ranking, followed by anterior blepharitis and soft contact lens wear. The highest mean rank for the GPs was tear deficiency, followed by soft contact lens wear and RGP (rigid gas permeable) wear. Interestingly, the higher ranking by the GPs for tear deficiency as a cause was not reflected in their response to the use of a specific diagnostic test, in particular to the use of the Schirmer test to confirm this as a possible reason. To detect MGD and anterior blepharitis, the use of a slit-lamp to provide a magnified view of the ocular surface as routine investigation technique is recommended, but this is usually only available to optometrists. When comparing the use of diagnostic tests, no agreement was found between optometrists and GPs. Indeed, GPs do not perform diagnostic tests as often as the optometrists. This may be due to having less time for each patient visit and/or limited access to specialised equipment needed.

Although more common for the GPs, the use of the Schirmer test by the optometrists was not a favourite. This may reflect a greater awareness by optometrists that the Schirmer test is no longer the first test used in diagnosing DED [15], [23]. Nichols et al (2000) found that only 8.5% of ophthalmologists in the USA used the Schirmer test for diagnosing dry eye disease. The study also identified symptoms as the most preferred single test for diagnosing dry eye disease, with fluorescein staining second [1], [9]. The Schirmer test was also preferred as the third or fourth diagnostic test by Spanish optometrists and ophthalmologists [2], [16], [17], and Australian optometrists also reported limited use of the Schirmer I (5%), or Schirmer II test (3%) [13]. A much better overall diagnosis for dry eye is to use a combination of tests. Both Gardona et al. 2011 [2] and Pult at al have reported that
there is a need to combine tests with a dry eye questionnaire to increase specificity and sensitivity in DED diagnosis [6].

For the possible causes of developing dry eye, the only agreement between the GPs and optometrists was with age-related, which was the top rank, which is consistent with the average age of DED patients they see in practice. Using the mean ranking, both the optometrists and GPs had work-related causes in their top three highest mean ranking. Although not shown statistically, the work-related cause may arise from common experience, since patients may complain of dry eye issues while at work [24]. The optometrists gave hormonal changes as a factor for developing dry eye, while the GPs had this cause as their lowest mean rank. Hormonal changes have been discussed as a possible cause for developing dry eye [25]. The female sex, blood oestrogen levels and the menopause are known as predictors in developing dry eye [26].

Looking at the survey results generally, the GPs have a less extreme range of opinions than the optometrists, which could be explained by differences in knowledge and/or specialisation between the two healthcare professionals. Or it could be due to a lower level of knowledge about dry eyes among the GPs. Also the work experience of both professions was not taken into account and this could influence their responses. Similarly, the population type and average age of the patients seen in routine practice could also influence the answers given. A study investigating diagnosis of eye pathology and dry eye disease between GPs and Ophthalmologists in the UK found that these were all factors, but any similar study has not been done in the Netherlands, to the authors’ knowledge [27].

More GPs did not complete all the questions. For the investigative techniques this can reflect either that the tests were unfamiliar, that the tests are not used in a normal GP practice, or that they are seen as being unusable in a GP practice. In general, the trend in this study is that the GPs do not frequently use any of the diagnostic tests. There were also some unusual answers for a few GPs who report using tests for diagnosing dry eye disease, such as lissamine green, osmolarity measurement and BUT – osmolarity measurement is not a common test, nor is the use of lissamine green compared to the more commonly used fluorescein.

In the survey of treatment options, agreement was only found between optometrists and
GPs in the prescribing of gel/ointment. Also, the optometrist more often prescribed artificial
tears without preservatives, while the GPs prescribed them with preservatives. The
reluctance to use artificial tears with preservatives by optometrist could reflect a greater
awareness of the latest opinions about preservatives [28]. In contrast, the GPs motivation
may be influenced by the fact that artificial tears with preservatives can be reimbursed by
health insurers, although this aspect was not specifically investigated in this study. In
contrast, optometrists are more focussed on other treatment options, such as *lid hygiene*
and *warmth therapy*. More often than the optometrists, GPs prescribe drops and ointments
with and without preservatives. This goes against the MGD Workshop Report which states
that it is particularly inappropriate and inefficient to use artificial tears with dry eye patients
who have an evaporative aetiology [29].

While the analyses are not specific enough to make a statement about the behaviour of the
optometrist in managing the dry eye patient, it seems that the optometrist is more focussed
on eyelid disease, such as blepharitis and MGD. Since their “standard” equipment is more
likely to include a slit-lamp and their education towards the anterior segment includes
assessment and diagnosis. In contrast, it appears the GPs approach is more subjective-
based (symptoms) than objective-based (tests). This may reflect the finding that dry eye
investigative techniques are not performed as a standard procedure, which itself may be
due to eye care forming just a small part of their daily work. Such a view is evident from the
high numbers of GPs who do not perform dry eye tests on their patients, and from them
having less knowledge of the recent research of dry eye.

Overall, the variety in answers given by optometrists in the Netherlands shows a lack of
uniformity in the use of investigative techniques, in the therapeutic options given, and in the
symptoms associated with dry eyes found in their practices. This lack of uniformity was also
observed in the Downie et al. 2013 investigation of Australian optometrists regarding their
use of investigative techniques, management and the use of evidence-based guidelines for
dry eye diagnosis and management [13].

The need for, and content of, guidelines and plans of management for a health condition is
always a source of debate in all parts of medical practice, and is true also between dry eye
specialists, ophthalmologists, optometrists and cornea specialists [13], [16], [30]. However,
the evidence from this study shows that there is a need to establish better management guidelines for dry eye in the Netherlands that includes GPs, optometrists and ophthalmologists in a manner beneficial to patient care.

**Limitations**

This investigation does have some limitations, primarily from the small percentage of survey respondents from the total pool, and the difference in numbers of optometrists and GPs recruited. This might be due to the different recruitment methods used. For the optometrists, they received an invitation via the optometric board and a known investigator, while the GPs were sent an email directly by the investigator. Since only GPs with an open access email address were invited, this could mean that only a selective group was invited. However, given these limitations, this survey has good internal consistency, with Cronbach alpha coefficients reported of 0.833 for the GPs and 0.885 for the optometrists (values range from 0 to 1, with higher values indicating greater reliability). For this kind of survey, a Cronbach alpha of >0.7 indicates a reliable survey [31]

**Conclusion**

The investigation, diagnosis and treatment of dry eye disease vary significantly between optometrists and GPs in the Netherlands. The optometrists perform more specific tests and see more dry eye patients per week, but the level of variance in responses between optometrists indicates that clear guidelines on dry eye management are needed to improve consistency. GPs rely more strongly on patient symptoms and are less likely to use alternative treatment methods. These results have implications in the development of future clinical care pathways for dry eye disease management in the Netherlands.

**Conflict of interest statement**

No competing financial interests exist.

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