A New Multipurpose Solution with Hyaluronate and Allantoin for All Types of Soft Contact Lenses

Clinical Study Results in Three Different Groups of Contact Lens Wearers

Dr. O.-Chr. Geyer*, Prof. Dr. Chris De Bruijn**, Detlef Garlipp MSc***

* Institut für Medizinische Sehhilfen Dr. Geyer GmbH, 35576 Wetzlar
** IPMG - Institut für Präventiv-Medizinisches Gesundheitsmanagement, 46342 Velen
*** Müller-Welt Contactlinsen Vertriebs GmbH, 70499 Stuttgart

Summary

Although many patients are switching to wearing contact lenses all the time, the number of contact lens wearers is not increasing noticeably. This is due to the roughly equal number of dropouts. The causes of complications have long been known and apart from the lens material itself, contact lens care has been identified as a decisive factor [1][2]. Manufacturers respond to this with care systems containing wearing comfort enhancing, mostly moisturising substances. In the present study, for the first time a new care system (*****) using the advantages of the biological substances hyaluronate and allantoin has been evaluated. Hyaluronate is used in ophthalmology as a physiological, long-lasting, visco-elastic tear substitute preparations. This substance's effect is also used for contact lens rewetting. Allantoin is used in dermatology for its cell protecting and cell regenerating capacities. In addition, it supplies the cornea with moisture and compensates for irritations.
From previous studies it was already known, that the “natural” multipurpose solution evaluated in the present study has excellent cleaning and disinfecting capacities and that it does not exhibit any cytotoxicity (according to ISO and US Pharmacopeia criteria).
The present clinical study of 30 subjects presents an analysis of the ophthalmological findings in first-time contact lens wearers, existing wearers and contact lens wearers with tear film problems. It is shown that for all three categories this novel multipurpose solution is excellently suited, especially when it comes to lens wearing comfort and corneal health parameters.

Introduction

In the field of ophthalmology, hyaluronate has become the rewetting substance of choice. Hyaluronate is unrivaled with respect to important parameters such as "moisture delivery" and "sustained effect", especially where both tear film problems and contact lens rewetting are concerned. Therefore, almost every manufacturer who

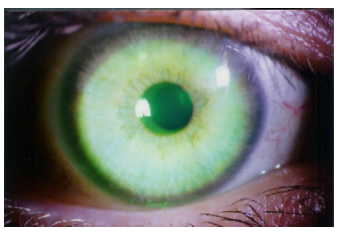
*(*) Commercially available as **"Perfect Aqua Plus"** from MPG&E, Bordesholm, Germany and **"Aqua Balance"**, from Lapis Lazuli International NV, Almere, The Netherlands.*

wants to address these issues, has included a rewetting eye drop preparation containing hyaluronate in its portfolio. Until recently, a practical disadvantage has been that even after the manufacturing methods have been switched from animal sources (e.g. rooster combs) to microbiological organisms (e.g. *Streptococcus equi*), not only was the visco-elastic active substance relatively unstable as a consequence of the isolation procedures, it was also very expensive and therefore not very economic for use in contact lens care. A totally new, patented and more gentle production process facilitated more economic production of considerably more stable hyaluronate. Thus, it is now possible to use hyaluronate in effective concentrations in contact lens care too.

When developing the formula of this new multipurpose solution, consideration was also given to the fact that wearing contact lenses often entails a certain amount of stress on the eye. A substance was sought with a "calming" and protective effect on corneal and conjunctival epithelial cells. Allantoin (the use of which in contact lens care products and eye drops is patented worldwide) meets this requirement. The formulation of this novel multipurpose solution produced outstanding results in the standard trials including disinfection efficacy, cleaning capacity and lens compatibility. The objective of this study was to investigate the product's properties in daily use and more particularly its effects on clinical parameters of ocular health in relation to contact lens wear in three different groups of contact lens wearers (beginners, regular users and patients with tear film abnormalities).

Methods and materials

Test solution: “Aqua Balance”, containing recombinant Hyaluronate (Eur. Pharm.) and Allantoin; disinfecting/preserving agent: Biopolydol 2.
At base examination (T=0), the anterior eye segment in 10 “first-time contact lens wearers”, 10 “existing wearers” and 10 wearers with tear film abnormalities was examined. Further examinations took place after 14 (T1) and 30 days (T2).
The existing contact lens wearers and the group with tear film abnormalities previously used the following care systems: Complete Moisture Plus (AMO) 10, Optifree Express (Alcon) 4, Renu Multiplus (Bausch & Lomb) 1, Regard (Vitaresearch) 1, Yes Kombilösung 1.
All participants in the study received new contact lenses at the initial examination (same lenses for the existing wearers: for the fist-time wearers: Perfect Contactlenses / ECCO Change from MPG&E, Bordesholm).
The contact lenses were worn daily and essentially for more than 8 hours. Care was in accordance with the manufacturer's instructions (“no rub” regimen).
Epithelial cell defects of the cornea (“corneal staining”) and conjunctiva were identified using lissamine green (Lissaver-Plus Franck Gouchet Pharma+).



Lissamine staining - no abnormalities detected

Compared with other methods, lissamine green stain has the advantage that it is easier to use for the person conducting the examination and it is tolerated better by the contact lens wearers. Furthermore, the staining is more sensitive [3].

The objective examinations covered 3 areas:

1. Split lamp examination of the cornea and conjunctiva with findings evaluated according to:

    a. corneal oedema
    b. stinging
    c. corneal vascularisation
    d. scleral injection
    e. tarsal anomaly
    f. lissamine green staining (“corneal staining”)
    g. other findings

2. Visual acuity test

3. Lens findings evaluated according to:

    a. deposits
    b. discolouration
    c. scratches
    d. rewetting
    e. lens positioning

All findings were rated according to score 0 (no abnormalities detected) to score 4 (serious). Only lissamine green stain was broken down into scores 0-6 according to Berke [3]. Lens results were also divided into 0-4; lens positioning was described as "all right" or "wrong". All findings were investigated and documented at every examination point (T0, T1, T2). Additional abnormalities were noted. Subjects were selected according to the criteria “first-time contact lens wearer”, “existing wearer” and “wearer with tear film abnormalities”.

Furthermore, every subject was asked for her/his subjective opinion on the following criteria:

A. When inserting the contact lenses, did they feel like a foreign body
    a. Not at all
    b. A little
    c. Noticeably
    d. A lot

B. After the contact lens was inserted was the eye
    a. Not red
    b. Slightly red
    c. Red
    d. Very red

C. Whilst wearing the contact lenses, was it
    a. Not possible to feel them
    b. Possible to feel them slightly
    c. Possible to feel them clearly
    d. Possible to feel them a lot

D. Compared with the care system used previously, is the care system being tested here
    a. Better
    b. The same
    c. Worse

E. Compared with the previous care system, is the feeling of dryness
    a. Less pronounced
    b. About the same
    c. More pronounced

Criteria for inclusion

The inclusion criteria for the subjects were:

- Subject is >18 years old or parental consent has been given, respectively
- Subject is available for the duration of the study and will follow instructions
- Subject's eyes reveal no other abnormalities (other than defective vision/tear film)
- Subject needs contact lenses for both eyes and has a visual acuity at distance of 0.5 as a minimum
- Subject receives new lenses and will wear them daily
- Subject is in good general health
- Subject is physically capable of handling study lenses, taking part in the control examinations and following the care instructions

Results

Slit lamp findings

For each of the three groups of contact lens wearers, the changes in the findings at points T1 and T2 were compared on the basis of the initial examination (T0). The results with the group of “first-time contact lens wearers” are shown in Diagram 1.
At base examination (T=0), in this group no abnormalities were detected, except for the lissamine green staining (the score in all individuals was evaluated as degree 1, i.e. “very slight”).
Both the trend in the number of findings and the degree of occurrence is decisive for analysis of the changes compared with the initial situation. This is expressed in the "weighted results". The weighted results therefore take account of both criteria and are defined as the number of findings multiplied by the respective degree of occurrence. The changes observed at points T1 and T2, as compared with the initial findings, are depicted in Diagram 2.
The “lissamine green” findings decreased steadily, most clearly between T1 and T2. The findings of “injections” were somewhat increased at point T1 (all in score 1), then decreased again thereafter. No other abnormalities were detected.

"First-time Wearers" Group

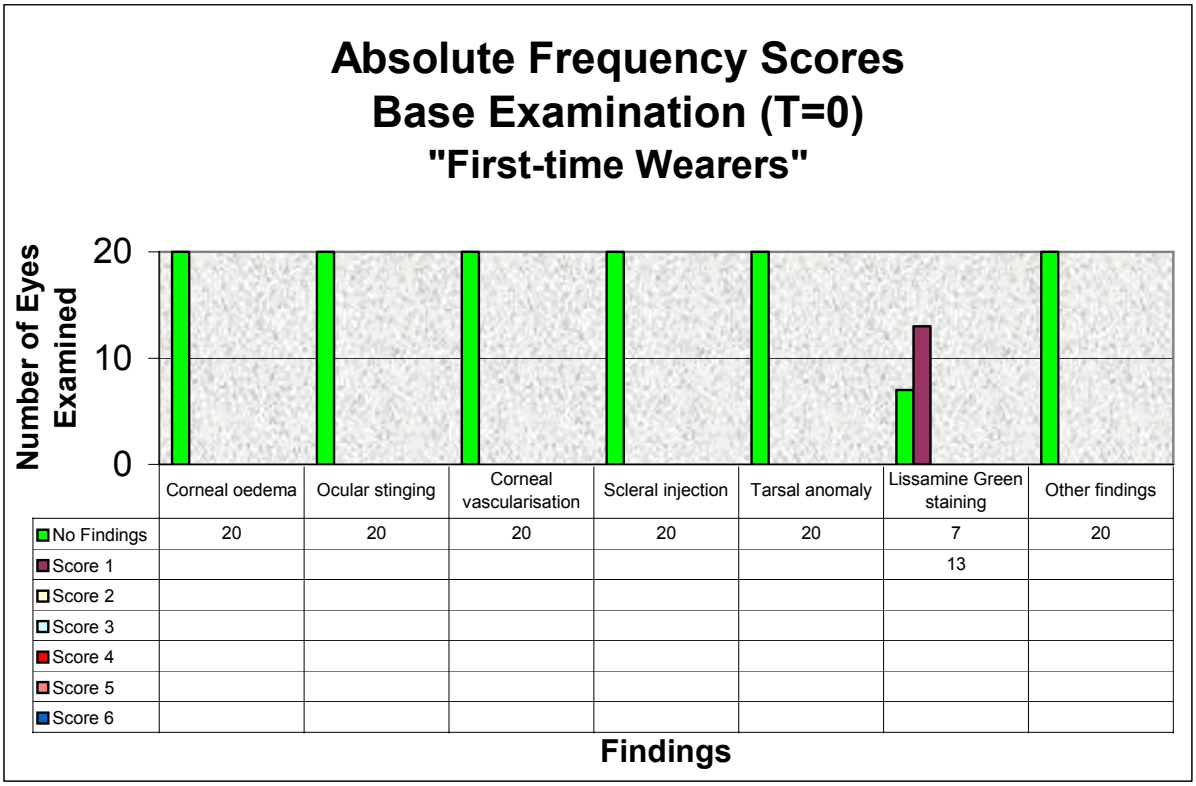


Diagram 1: Base examination - "First-time Wearers" group

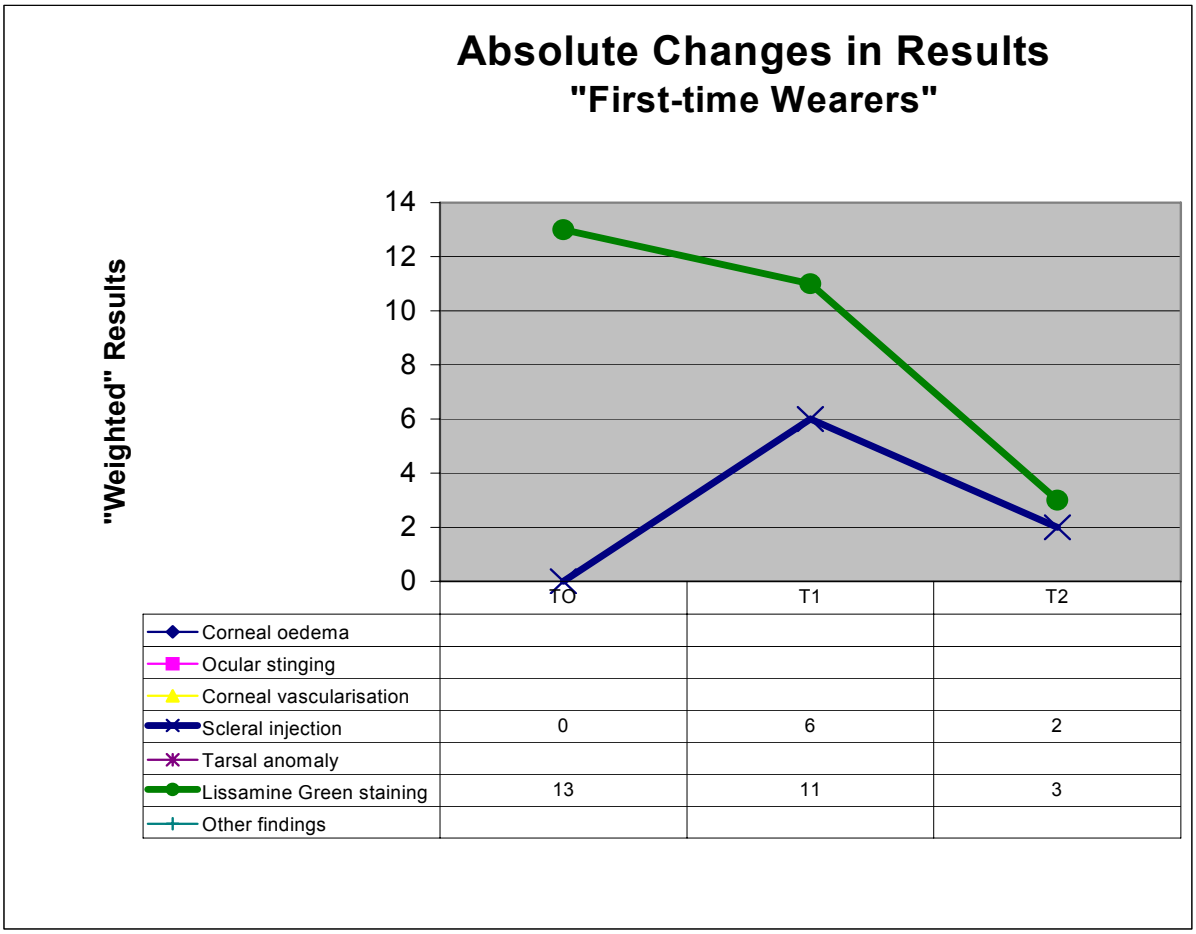
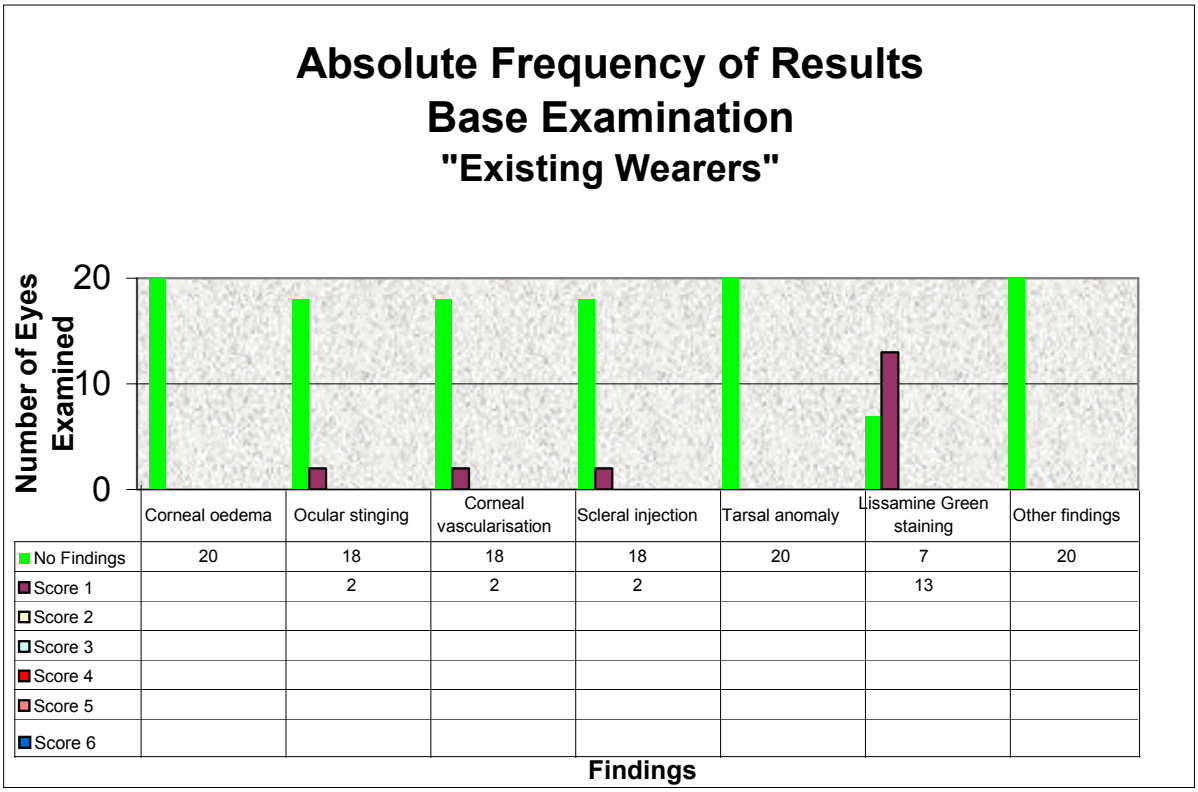


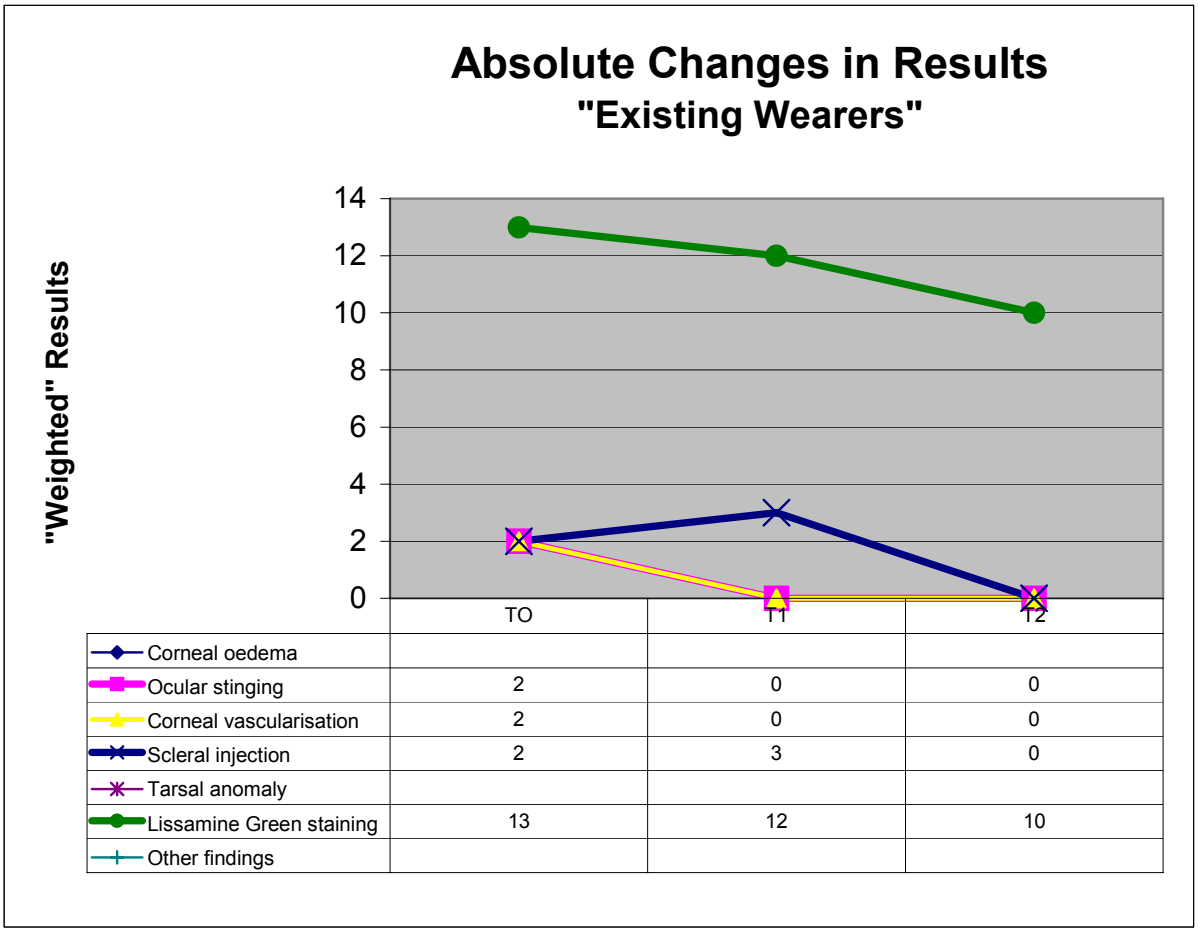
Diagram 2: Results trend for "First-time Wearers" group

"Existing Wearers" Group



	Corneal oedema	Ocular stinging	Corneal vascularisation	Scleral injection	Tarsal anomaly	Lissamine Green staining	Other findings
No Findings	20	18	18	18	20	7	20
Score 1		2	2	2		13	
Score 2							
Score 3							
Score 4							
Score 5							
Score 6							

Diagram 3: Base examination - "Existing Wearers" group



	TO	T1	T2
Corneal oedema			
Ocular stinging	2	0	0
Corneal vascularisation	2	0	0
Scleral injection	2	3	0
Tarsal anomaly			
Lissamine Green staining	13	12	10
Other findings			

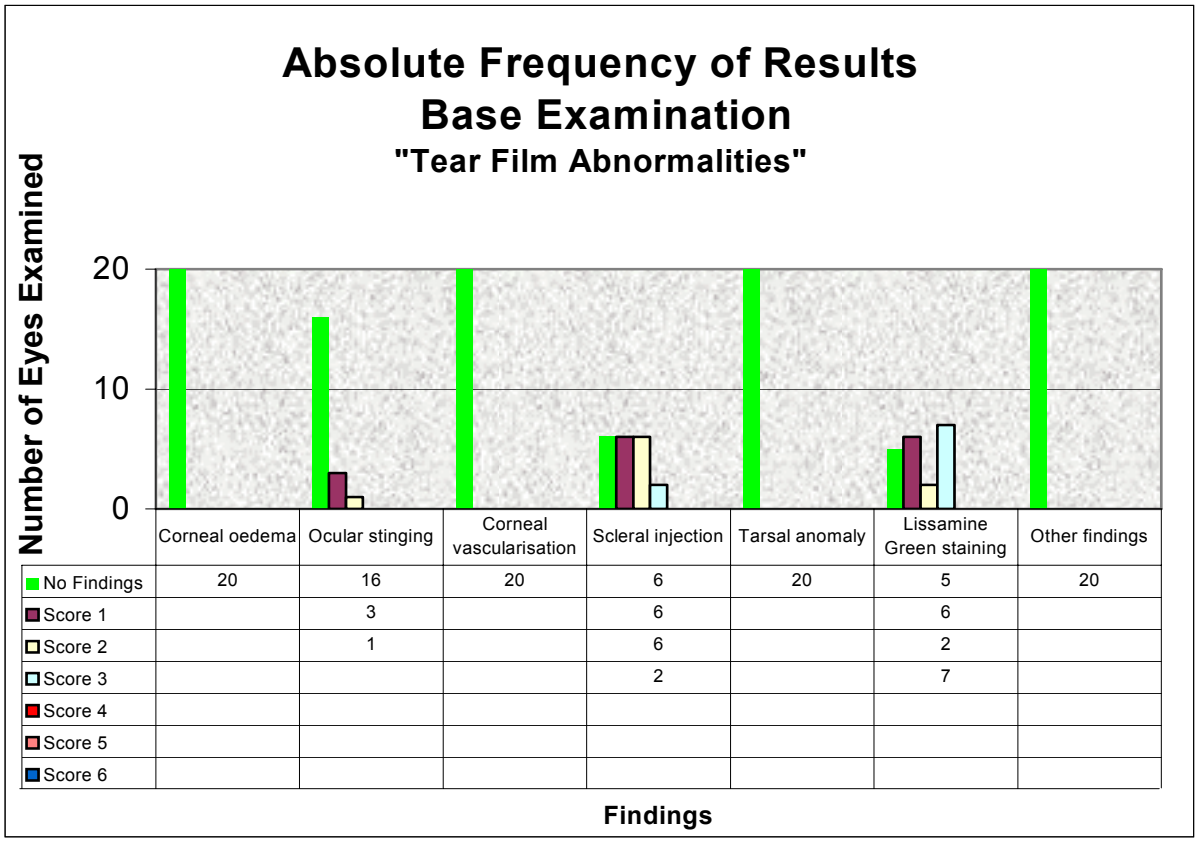
Diagram 4: Results trend for "Existing Wearers" group

As was the case with the “first-time” contact lens wearers, the “lissamine green” results for the existing wearers were the most marked. Furthermore, the base examination identified “stinging”, “vascularisation” and “injections” (each score 1).

All results improved in the follow-up examinations. “Vascularisation” and “stinging” were no longer detected after T1. Whilst a slight increase in “injections” was observed at T1, it was no longer possible to identify this at T2. The “lissamine green” results also improved.

"Tear Film Abnormalities" Group

As expected, this group exhibited the most findings. “Stippling” and “injections” were observed in addition to the “lissamine green” findings. Furthermore, the grades of abnormalities were clearly more pronounced as compared to the two previous groups: up to score 3.



	Corneal oedema	Ocular stinging	Corneal vascularisation	Scleral injection	Tarsal anomaly	Lissamine Green staining	Other findings
No Findings	20	16	20	6	20	5	20
Score 1		3		6		6	
Score 2		1		6		2	
Score 3				2		7	
Score 4							
Score 5							
Score 6							

Diagram 5: Base examination - “Tear Film Abnormalities” group

In view of the multitude of findings at base examination, it was precisely in this problematic group, that significant positive changes in these parameters were observed at T1 and T2.

The “lissamine green” and “injection” results decreased steadily. No “stippling” was detected at point T1. The increase in “vascularisation” at T2 can be traced back to the peculiar findings in one patient. At base examination, this patient had score 3 for “injections” on both sides. The situation in both eyes improved to score 1 at T1, whereas at T2 no “injections” were observed anymore. Instead, in this patient “vascularisations” were apparent at T2, so all in all a difficult patient to treat.

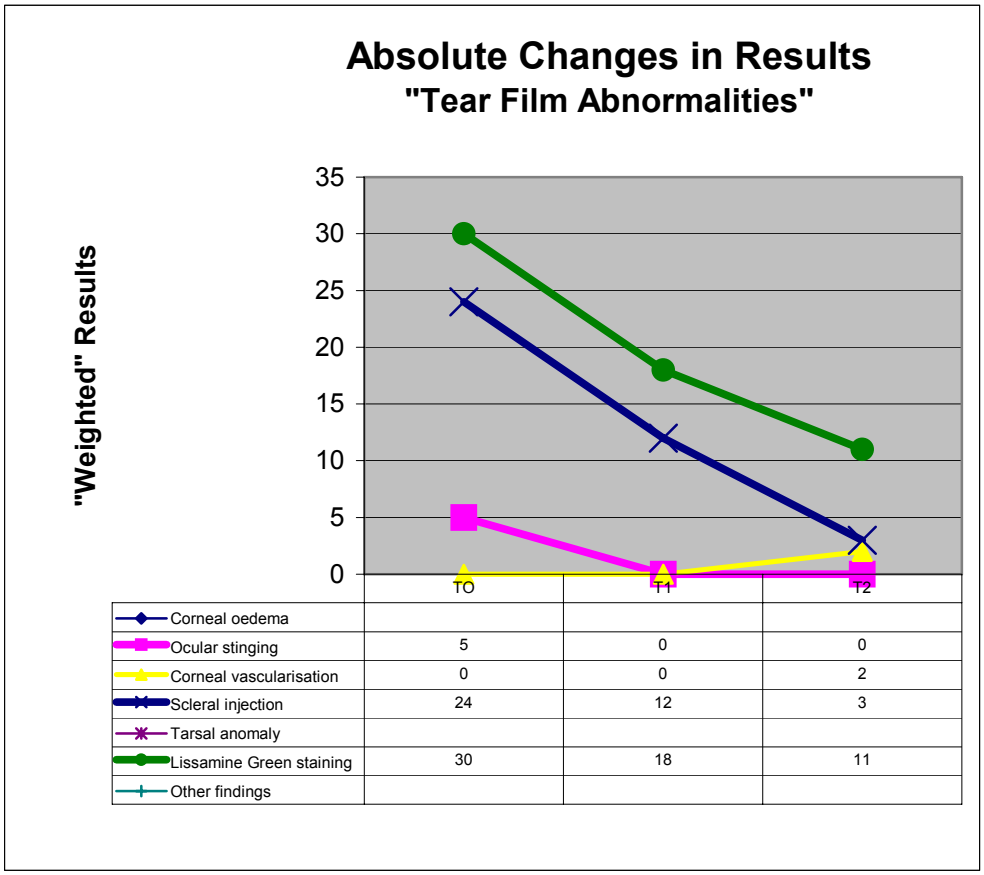


Diagram 6: Results trend – "Tear Film Abnormalities" group

Visual Acuity

In all patients, maximal visual acuity was observed at T=0, T1 and T3.

Lens findings

Findings with the lenses were inconspicuous: incorrect handling resulting in scratches in the case of "first-time wearers" and a few low grade 1 scores for deposits in "first-time wearers" and "existing wearers". As could be expected, deposits were more frequently observed in the "tear film abnormalities" group (4 subjects; see Discussion).

Subjective evaluation by "existing wearers" and "tear film abnormalities" groups

The test solution was rated as "better" by around half of the "existing wearers" and "problematic tear film" group. Results can be seen in detail in Diagram 7. Two persons gave a lower rating to the test solution.

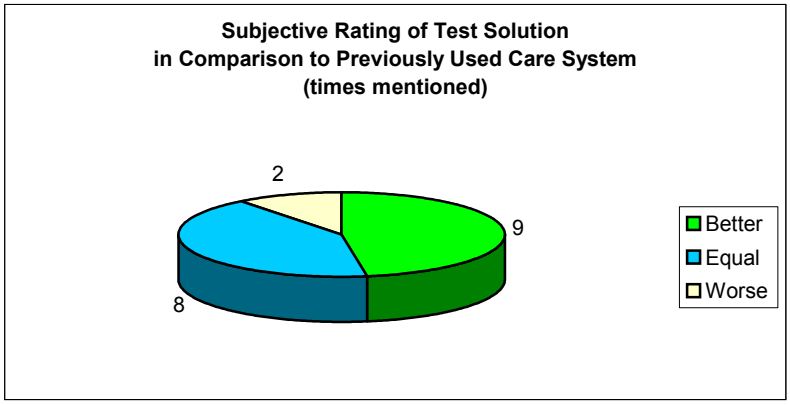


Diagram 7: Overall subjective rating of test solution in comparison to previously used system

A similar picture emerges when the “feeling of dryness” is considered. Here, 8 subjects were of the opinion that the feeling of dryness was less marked with the test solution, whereas ten persons did not notice a difference. One person gave a lower rating as compared to the previously used care system (Diagram 8).

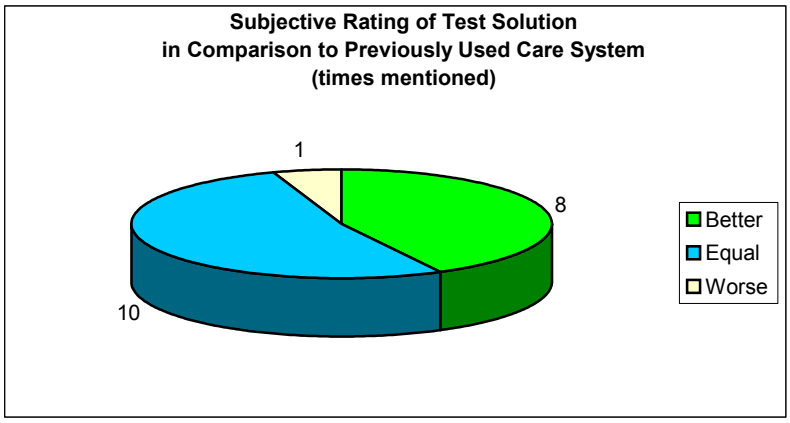


Diagram 8: Subjective rating of "feeling of dryness"

Practically no patient experienced contact lenses awareness either when inserting them or during wear.
The subjective evaluation of wearing comfort during insertion (Diagram 9) and during prolonged wearing (Diagram 10) shows that none of the test persons experienced any discomfort. In two individuals, a low grade of reddening (score 1) was observed during prolonged wearing.

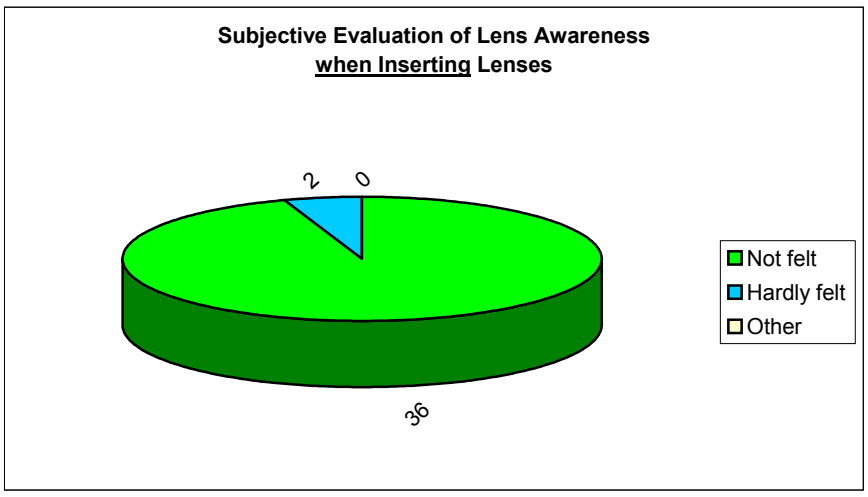


Diagram 9: Subjective evaluation of contact lens comfort during insertion

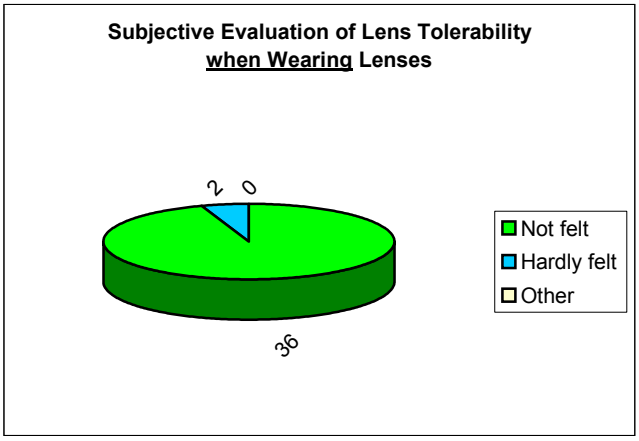


Diagram 10: Subjective evaluation of contact lens comfort during wearing

Discussion

The results of this investigation unambiguously show the positive effects of this new care product containing the natural substances hyaluronate and allantoin on the physiological situation in the contact lens wearer's eye. During the observation period of 4 weeks, in all three groups the initial findings markedly improved. Especially, the improvements in the subjects with tear film abnormalities strongly suggest a contribution to less complicated contact lens wearing and, consequently, to sustained eye comfort.

The "injection" findings in the **"first-time wearers"** group at T2 can be ascribed to the start of contact lens wearing process (Diagram 2). Right at the start, the eye particularly experiences mechanical and psychological stress. By the end of the investigation, in this group only minor weak findings (score 1) were present.

A clear improvement in findings was also ascertained in the "**existing wearers"** group (Diagram 4). Since the effects of habituation tend to play no further role in this case, the positive effects can be ascribed to the solution.

The positive effects of this new solution were especially pronounced in the "**tear film abnormalities"** group (Diagram 6). By the end of the observation period, both the "lissamine green" results ("corneal staining"), the "stippling" and "injections" were much less frequent and also occurring with lower scores. The "vascularisation" findings at T2 can be ascribed to the problematic situation in the eyes of one patient and is not directly related to the care product. On the contrary, in this patient, the parameter "injection", decreasing from score 3 (at T0) to score 0 (at T2), is much more an indication of the positive effects of the test solution.

The inspection of the lenses showed that the test solution cleaned and maintained the lenses very well. In the group of individuals with "tear film abnormalities" there is generally a greater tendency to deposition. This is also confirmed by our investigation. Deposits were detected in 4 subjects, which were no longer present after the subjects had been re-instructed about hygiene. Generally speaking, patients should be reminded of care instructions at shorter intervals (around 6 weeks) after conversion [4].

Contact lens tolerability on insertion and during wear was excellent. One wearer reported a low degree of lens awareness (Diagrams 9 and 10). If one considers that the contact lenses in all groups were worn for more than 8 hours a day, this result is excellent and is indicative of a good compatibility between lens materials involved and this new care product. The contact lenses' very good tolerability is an important aspect in preventing contact lens wearers from discontinuing wearing them.

Concerning the **subjective evaluation**, half of all wearers rated this new care product as better than the one that they had been using previously (Diagrams 7 and 8). In other words, around half of the subjects were more satisfied with the new product than with the previous ones, all representing state-of-the-art care product technology.

It is concluded that this new solution, focusing on the use of natural, eye protecting and contact lens compatible substances such as hyaluronate and allantoin, reduces and prevents symptoms such as lens awareness, irritation, dryness and corneal staining. Its use will significantly contribute to contact lens wearer satisfaction and may lead to lower numbers of consumers that discontinue contact lens wear.

Contact

Lapis Lazuli International NV
Damsluisweg 48
NL 1332 ED Almere
Phone: +31 (0)36 547 6020
Fax : +31 (0)36 547 6021
Web : www.lapislazuli.nl
E-mail: info@lapislazuli.nl

References

[1] Roth, H.W., Zur Problematik der Konservierungsstoffe in Kontaktlinsenpflegemitteln [On the problems of preservatives in contact lens care products], Der Augenspiegel, 6/88
[2] Roth, H.W., Ursache und Häufigkeit von Komplikationen beim Kontaktlinsentragen [Cause and frequency of complications when wearing contact lenses], Der Augenspiegel, April 2000
[3] Berke, A., Färber, R., Lissamingrün: Verträglichkeit und Färbecharakteristika [Lissamine green: tolerability and stain characteristics], die Kontaktlinse 6, 2002, 30-32
[4] André, M., Contact Lens Care Products: Problem or Solution?, Contact Lens Spectrum, July 2004, 37-40