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Ocular manifestations of psoriasis

Manifestações oculares observadas em pacientes com psoríase

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ABSTRACT | Purpose: We aimed to report the ocular manifestations observed in patients with psoriasis. **Methods:** Patients were included and referred to our ophthalmology clinic from dermatology clinics of Universidade do Estado do Pará between October 2013 and August 2014. Clinical interviews were conducted to identify relevant epidemiological data, clinical features, and treatment details, and data were recorded using the same protocol. Subsequent dermatological examinations were performed and disease severity was rated using the Psoriasis Area and Severity Index and the Dermatological Life Quality Index. Complete eye examination was conducted, including visual acuity, biomicroscopy, tonometry, fundoscopy, Schirmer I test, tear breakup time, rose bengal staining, ocular surface disease index, and glaucoma tests. **Results:** In total, we included 43 patients with psoriasis and 86 controls. Patients with psoriasis had statistically higher incidences of dry eye (16.28%), likely dry eye (32.56%), and blepharitis (16.28%). Furthermore, the rose bengal and ocular surface disease tests were more abnormal in patients with psoriasis ($p<0.05$). **Conclusions:** Patients with psoriasis should undergo regular eye exams, regardless of risk factors, to monitor for the progression of symptomatic or asymptomatic ocular manifestations.

Keywords: Psoriasis; Ocular manifestations

RESUMO | Objetivos: Relatar as manifestações oculares observadas em pacientes com psoríase atendidos no Ambulatório de Dermatologia da X e encaminhados ao Y, no período de outubro de 2013 a agosto de 2014. **Métodos:** A amostra foi constituída por um grupo composto por 43 pacientes com psoríase e um grupo controle com 86 pacientes sem psoríase. Foi realizada uma entrevista clínica com dados epidemiológicos, aspectos clínicos da doença e terapia empregada, sendo todas as informações registradas em protocolo próprio. Posteriormente, realizou-se o exame dermatológico, no qual foi avaliado o índice de gravidade da Psoríase por área (PASI) e índice dermatológico de qualidade de vida (DLQI), e o exame oftalmológico completo, incluindo: Acuidade Visual, Biomicroscopia, Tonometria, Fundoscopia, Teste de Schirmer I, Tempo de Ruptura do Filme Lacrimal (TBUT), rosa bengala, índice de doença da superfície ocular (OSDI) e exames para glaucoma. **Resultados:** Observou-se que nos pacientes com psoríase houve frequência estatisticamente maior de envolvimento ocular, como olho seco (16,28%), provável olho seco (32,56%) e blefarite (16,28%). Além disso, os valores do rosa bengala e do OSDI apresentaram-se mais alterados nos pacientes com psoríase ($p<0,05$). **Conclusão:** Dessa forma, sugere-se que esses pacientes realizem exames oftalmológicos periódicos, já que as manifestações oculares podem progredir sem sintomatologia e ocorrer independentemente de fatores de risco.

Descritores: Psoríase; Manifestações oculares

INTRODUCTION

Psoriasis is a systemic condition that affects 1%-3% of the world's population and has a profound impact on quality of life[1]. It is a chronic inflammatory skin disease in which environmental and genetic risk factors cause immunocellular dysfunction and inflammation[2]. Although the most common clinical manifestations involve the skin, with clearly defined erythematous and squamous plaques, other sites can also be affected. Beyond the nails and joints, ocular involvement is particularly common and affects 12% of cases[3,4]. To date, however, few studies have correlated ocular and dermatological manifestations in patients with psoriasis. We aimed to describe the ocular manifestations observed in these patients.

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Approved by the following research ethics committee: Universidade do Estado do Pará (# 307, 701/2013).

METHODS

This case-control study was conducted after receiving approval from our research ethics committee (number 307,701, 2013). We enrolled patients with psoriasis who received treatment at our dermatology clinic (cases) and compared them with age and gender matched volunteers (control). The study was conducted between October 2013 and August 2014.

All patients with a dermatological and histopathological diagnosis of psoriasis and treated at our Clinic up to October 2013 were considered for inclusion. The control group included relatives and companions of the included patients, plus patients treated at other outpatient clinics in our hospital. In both groups, patients were excluded for the following reasons: if they did not want to participate; if they had sarcoidosis, systemic lupus erythematosus, Behcet's disease, tumors, infection, ocular trauma or allergy, abnormal eyelid movement, or a history of ocular surgery; if they used contact lenses; or if they were receiving treatment with retinoids, psoralen and ultraviolet A radiation (PUVA), or narrow-band ultraviolet B (UVB) radiation.

An interview was conducted in which the following data were collected from participants: gender, age, age at onset (before or after 40 years), clinical phenotype, duration of psoriasis, and current treatment. Arthropathic psoriasis was only considered if it had been diagnosed by a rheumatologist. The degree of skin involvement was evaluated using the Psoriasis Area and Severity Index (PASI), with scores equal to or greater than ten considered to indicate moderate or severe disease. The Dermatological Life Quality Index (DLQI)[5] was used to evaluate quality of life. Finally, a complete eye examination was performed, including visual acuity, biomicroscopy, tonometry, fundoscopy, Schirmer I test, tear breakup time (TBUT), rose bengal staining, ocular surface disease index (OSDI)[6], and glaucoma testing.

Normal vision was considered when the visual acuity was ≥0.66. Dry eyes were diagnosed according to Japanese criteria, which required that patients had clinical symptoms and at least two positive results from among the Schirmer I test, the TBUT test, the rose bengal test, and the presence of keratitis. Patients who met only two criteria were classified as having probable dry eyes. Although dry eye and keratoconjunctivitis sicca (KCS) are not synonymous, we adopted the accepted dogma and assumed that the terms were interchangeable[7].

The Schirmer I test was conducted over five minutes, without topical anesthesia, and any measurement less than 10 mm was considered abnormal. The TBUT was performed using 1% fluorescein and was considered abnormal if the mean tear breakup time was less than 10s[8]. Concerning the presence of stained corneal lesions, patients were classified according to the presence or absence of superficial keratitis. In the rose bengal test, each eye received a score between zero and nine, and values greater than three were considered abnormal[9]. A questionnaire based on the OSDI was administered to assess dry eye symptoms, with the final scores analyzed according to the OSDI interpretation scale[10].

Statistical analysis was performed as appropriate, adopting a significance level of $\alpha=0.05$.

RESULTS

We identified a potential 214 patients for inclusion in the psoriasis cohort. However, only 43 attended their consultations, with non-attendance resulting from the presence of exclusion criteria, lack of interest in participating in the study, inability to contact the patient, or change of residence to other cities and states. The participants included 21 women (48.84%) and 22 men (51.16%), with a mean age of 47.88 ± 14.61 years. The control group included 86 volunteers. The details of the two groups are summarized in table 1.

Regarding the clinical forms of psoriasis, large plaques were the most frequent (48.84%) ($p<0.05$). Additionally, 41.86% had psoriatic arthritis and 53.49% had nail psoriasis. Concerning the age at onset, 60.47% had psoriasis

Table 1. Comparison of the cases and control groups

	Psoriasis (n=43)		Control (n=86)		
General information	**N**	**%**	**N**	**%**	
Gender					
Female	21	48.84	46	53.49	0.7554
Male	22	51.16	40	46.51	
Arterial hypertension					
Yes	12	27.91	19	22.09	0.6101
No	31	72.09	67	77.91	
Diabetes mellitus					
Yes	7	16.28	5	5.81	0.1031
No	36	83.72	81	94.19	
Age (years)	**Mean ± SD**		**Mean ± SD**		
Overall	47.88 ± 14.6112		47.47 ± 15.3621		0.8848
Female	47.86 ± 14.7793		46.22 ± 16.5877		0.5575
Male	47.91 ± 14.7967		48.90 ± 13.8893		0.7095

diagnosed before age 40 years, and the mean disease duration was 11 ± 8.84 years. The severity indicators showed a mean PASI of 6.22 ± 6.75 and a mean DLQI of 5 ± 4.82 (Table 2). Most patients were using medication at the time of assessment, with methotrexate used most often, followed by topical Dovobet® (LEO Laboratories LTD/Dublin), etanercept, and adalimumab (Table 2).

Regarding the presence of ocular manifestations, there were some ocular findings in 81.40% and 60.47% of cases and controls, respectively (p<0.05) (Table 3). Few patients had corrected visual acuities ≤0.66 in the psoriasis (6.98%) or control (4.65%) groups, and the mean intraocular pressures (including patients with glaucoma) were 12.8 and 11.7 in the cases and controls, respectively (p<0.05) (Table 3). Biomicroscopy and indirect ophthalmoscopy identified that pterygium (34.88%), cataract (30.23%), blepharitis (16.28%), KCS (16.28%), probable KCS (32.56%), pingueculae (13.95%), keratitis (11.63%), and conjunctival hyperemia (9.30%) were common in patients with psoriasis. However, only the findings for blepharitis, KCS, and probable KCS were significantly different between the groups (p<0.05; Table 3).

In the KCS evaluation, 23 patients with psoriasis (53.49%) had an abnormal TBUT, 6 (13.95%) had an abnormal Schirmer I test, and 23 (53.49%) had an abnormal rose bengal test (p<0.05). Of these, 17 had KCS when evaluated by OSDI (p<0.05) (Table 4), but the presence of symptoms was unrelated to abnormal ocular test results (Table 5).

When ocular manifestations were analyzed by the PASI, most patients with blepharitis had a mild PASI (85.71%) (p<0.05), whereas most with keratitis (60%) had a PASI classified as moderate/severe (p<0.05). Furthermore, blepharitis and keratitis were more common when psoriasis began before the age of 40 years

Table 2. Characteristics of patients with psoriasis

General characteristic of the disease	Quantily	Percentage	P-value
Clinical form			<0.0001*
Erythrodermic	1	2.33	
Large plaques	21*	48.84	
Guttate	6	13.95	
Palmar-plantar	5	11.63	
Small plaques	10	23.26	
Psoriatic arthritis			0.3602
Yes	18	41.86	
No	25	58.14	
Nail psoriasis			0.7604
Yes	23	53.49	
No	20	46.51	
Psoriasis before or after age 40			0.2225
Before	26	60.47	
After	17	39.53	
Treatment for psoriasis (n=40)[4]			0.047*
Methotrexate	17	42.50	
Daivobet	13	32.50	
Etanercept	10	25.00	
Adalimumab	4	10.00	
No medication	3	6.98	
	Mean ± SD		0.4638
Duration of psoriasis	11 ± 8.8467		
Female	12 ± 9.9824		
Male	10 ± 7.6516		
PASI (%)	6.22 ± 6.7580		0.7386
Female	5.86 ± 5.6148		
Male	6.56 ± 7.8145		
DLQI	5 ± 4.8217		0.0404*
Female	7 ± 5.8064		
Male	4 ± 2.7524		

DLQI= the dermatological life quality index; PASI= psoriasis area and severity index.

Table 3. Ocular manifestations in cases and controls

	Group				
	Psoriasis		Control		
	N	%	N	%	p-value
Ocular manifestations					
Yes	35	81.40	52	60.47	
No	8	18.60	34	39.53	
Total	43	100.00	86	100.00	0.0284*
Most frequent ocular findings					
Visual acuity ≤0.66	3	6.98	4	4.65	0.6850
Cataracts	13	30.23	23	26.74	1.0000
Pterygium	15	34.88	20	23.26	0.5221
Pinguecula	6	13.95	17	19.77	0.0843
Blepharitis	7	16.28	1	1.16	0.0037*
Conjunctival hyperemia	4	9.30	1	1.16	0.0629
Keratitis	5	11.63	7	8.14	0.5327
Dry eye	7	16.28	3	3.49	0.0302*
Probable dry eye	14	32.56	12	13.95	0.0085*
Glaucoma	1	2.33	1	1.16	1.0000
Ocular pressure	12.8	± 2.3134	11.7	± 1.5893	0.0190*

(p<0.05) (Table 6). Keratitis was only present in patients with nail involvement (p<0.05). However, ocular manifestations were not related to the presence of psoriatic arthropathy (Table 6).

DISCUSSION

In this study, 81.4% of patients with psoriasis had ocular manifestations, which is markedly higher than the 12%-58% reported in other studies[4,11]. We believe that this high incidence was not by chance, and that our results indicate a valid correlation between psoriasis and ocular manifestations. However, because advances in diagnostic procedures may have improved the detection of ocular manifestations during the study period, we cannot conclude this definitively. Consistent with other research, no significant relationship was observed between ocular manifestations and either gender, age, or duration of psoriasis[11].

Previous studies have indicated that uveitis, conjunctivitis, blepharitis, and KCS are the most common ocular manifestations in patients with psoriasis[12,13], yet we failed to identify either uveitis or conjunctivitis. This can be explained by two factors: 1) our examination may have been performed before the appearance of these eye complaints, and 2) 93% of patients were already using appropriate medications. Thus, the occurrence or exacerbation of manifestations caused by severe inflammation may have been avoided.

Although pterygium and pingueculae were common, their strong relationship to sun exposure[14] means that this result most likely resulted from the study location. Also, cataracts are a common ocular disorder that are closely related to advancing age, so cannot be considered exclusively related to psoriasis. By contrast, there

Table 4. Abnormal test results in the case and control groups

	Group				
	Psoriasis (n=43)		Control (n=86)		
Abnormal test	N	%	N	%	p-value
OSDI	17	39.53	16	18.60	0.0246*
Dry eye	7	16.28	3	3.49	0.0302*
Probable dry eye	14	32.56	12	13.95	0.0317*
TBUT	23	53.49	35	40.70	0.2345
Rose bengal	23	53.49	25	29.07	0.0120*
Schirmer	6	13.95	5	5.81	0.1784

OSDI= ocular surface disease index.

Table 5. Eye tests according to the OSDI results of all patients

	OSDI				
	Mild/moderate (n=33)		Normal (n=96)		
Variable	N	%	N	%	p-value
TBUT					
Abnormal	15	45.45	43	44.79	0.8912
Normal	18	54.55	53	55.21	
SCHIRMER					
Abnormal	4	12.12	7	7.29	0.4706
Normal	29	87.88	89	92.71	
ROSE BENGAL					
Abnormal	14	42.42	34	35.42	0.6103
Normal	19	57.58	62	64.58	

OSDI= ocular surface disease index; TBUT= tear breakup time.

Table 6. Ocular manifestations according to the characteristics of psoriasis patients

		Ocular manifestations	
General characteristics		Blepharitis	Keratitis
PASI			
Mild	N	6	2
	%	85.71	40.00
Moderate/severe	N	1	3
	%	14.29	60.00
p-value		<0.0001*	0.0025*
Nail psoriasis			
Yes	N	2	4
	%	28.57	80.00
No	N	5	1
	%	71.43	20.00
p-value		<0.0001*	0.0016*
Psoriatic arthritis			
Yes	N	2	2
	%	28.57	40.00
No	N	5	3
	%	71.43	60.00
p-value		<0.0001*	0.0025*
After age 40 or not			
After	N	3	2
	%	42.86	40.00
Before	N	4	3
	%	57.14	60.00
p-value		<0.0001*	0.0025*

PASI= psoriasis area and severity index.

is greater biological plausibility for the increased rate in blepharitis in psoriasis (Figure 1; $p \leq 0.05$)[11,15], which may result from blockage of the tear ducts secondary to constant skin peeling[16]. Superficial punctate keratitis (Figure 1), opacities, increased epithelial thickness, recurrent erosions, ulcers, and scars have also been linked to psoriasis[15,17]. We found no significant difference in corneal involvement between cases and controls because the patients with psoriasis were already receiving antiinflammatory treatment[13].

Our key finding was the high prevalence of KCS and probable KCS in patients with psoriasis. This is supported by research showing that patients with psoriasis have a high rate of obstructive meibomian gland dysfunction[16]; although they produce normal amounts of lipid, dysfunction results from epithelial hyperkeratinization that covers the gland ducts[18]. Added to the super-expression of immunological proteins, this obstructs ductal secretion, leading to instability of the lacrimal film and causing epithelial corneal disease[16,18-20]. Although the number of cases of KCS detected in patients with psoriasis was consistent with the numbers detected in previous research[13,21], underestimation is possible because of the strict criteria used for diagnosis. In addition, dry eye can go unnoticed, especially in the early stages, where the typical signs and symptoms are less obvious.

Among the tests used to evaluate dry eye, the TBUT test is performed to assess tear film stability. Other studies have indicated that the mean TBUT is significantly lower in patients with psoriasis[22,23]. However, the lack of a significant difference in mean TBUT between the case and control groups in the current study may have been because of the high humidity in our region, which may have allowed the tear film to remain in the eyes longer and produce a normal test result. Though plausible, more studies are needed to confirm this hypothesis.

The rose bengal test (Figure 2) can be used to judge the severity of corneal and conjunctival involvement in diseases that affect the epithelium. As observed by Lima et al., it was notable that patients with psoriasis had quite abnormal rose bengal staining[13]. Also consistent with the results of other studies, the Schirmer test showed that there were no differences between patients with and without psoriasis[16,21,24]. This can be explained by the low sensitivity and specificity of the test for detecting KCS when used alone, because the heterogeneity of dry eye syndrome hinders making an abnormal finding[25]. Nevertheless, some studies have reported abnormal Schirmer test values in psoriasis[4,23].

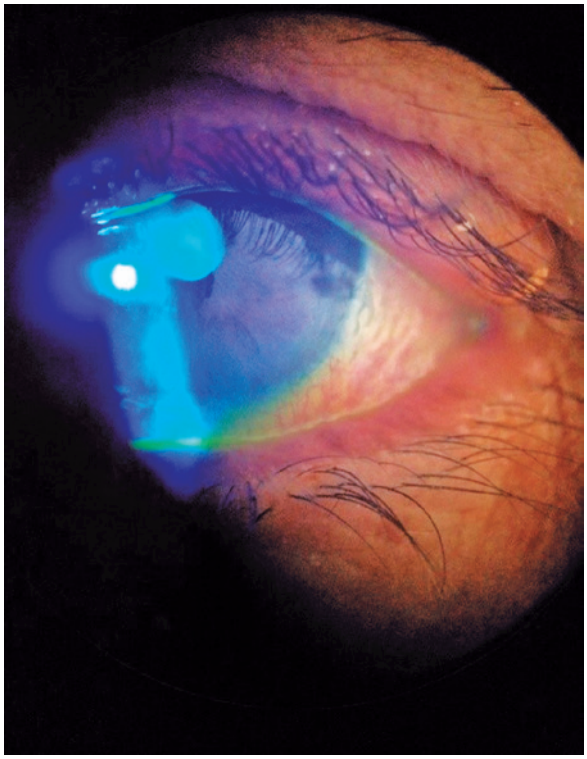

Figure 1. Keratitis and blepharitis in a patient with psoriasis.

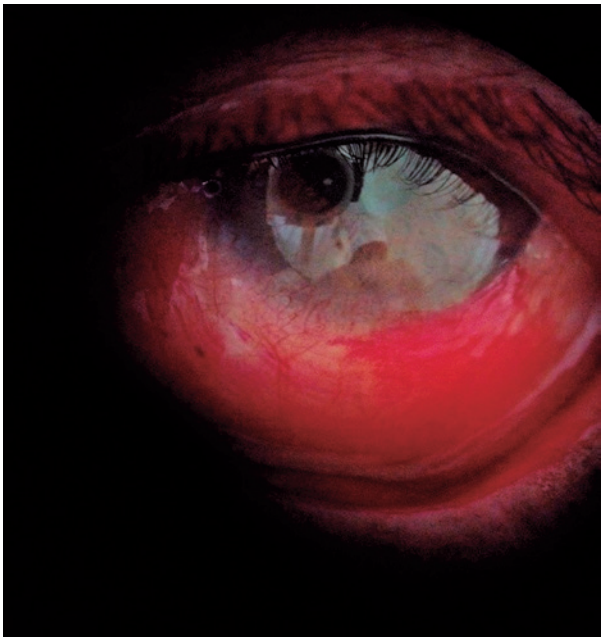

Figure 2. Rose Bengal staining in patient with psoriasis.

In KCS, it is known that symptom severity may not always match clinical signs; additionally, a significant proportion of patients can have conflicting signs and symptoms[26]. In this study, ocular symptoms by OSDI did not correlate with ophthalmologic signs, but were significantly higher in patients with psoriasis[24]; this is consistent with the results of other studies[13,27].

Psoriasis can be classified by its association with human leukocyte antigen (HLA). Patients who have a strong HLA association typically have a family history and present with disease before 40 years of age. If they carry two copies of HLACw6, they may develop a more severe and recalcitrant form of the disease[28]. Therefore, if an early onset of psoriasis is associated with greater disease severity because of the relationship to HLA, ocular manifestations like keratitis and blepharitis could appear more frequently in this group.

Using the PASI, which also measures severity, keratitis was shown to have a strong association with moderate/severe psoriasis, whereas blepharitis had a stronger association with mild psoriasis. As reported by Erbagci et al.[22], we found that symptoms on the PASI were generally unrelated to the occurrence of ocular manifestations. However, this finding conflicts with the results of other studies[15,29] and suggests that these changes can emerge at any stage of the disease. Ophthalmologic monitoring is required from disease onset.

It was noteworthy that, consistent with the results of Taborda et al.[30], women with psoriasis had significantly worse quality of life and greater psychological distress. This can be explained by the fact that proinflammatory cytokines related to psoriasis are also linked to depression, which is more common in women[31].

It has been suggested that arthropathic psoriasis is most often associated with eye disease[19,29]. However, supporting the research by Kilic et al., we found that ocular manifestations did not necessarily correlate with arthropathic disease[11]. Additionally, there was no clear association for blepharitis and keratitis ($p \leq 0.05$), with only keratitis being associated with nail psoriasis. Another study described a case in which an exacerbation of psoriasis was associated with keratitis, and involved only the nails and not the joints[32].

Most patients were treated with methotrexate, but we could not determine a statistical relationship between therapies and their influence on ocular manifestations because the sample was too small. In addition, because psoriasis is a chronic disease, commenting on this possible influence would require a complete history of the treatment, and our patients did not provide full accounts.

It is important to emphasize that the low visual acuity in our participants was either due to nuclear cataracts or injury of the eye fundus (e.g., juxta-macular scar tissue). Patients with microvascular abnormalities of the retina also had systemic hypertension. In addition, all cases of glaucoma were classified as primary open angle glaucoma, with the intraocular pressure not being clinically relevant, despite being slightly higher in patients with psoriasis ($p \leq 0.05$).

This research has some unavoidable limitations. First, because the study was conducted in a dermatology referral clinic, most patients had received appropriate treatment for psoriasis before their ophthalmological examination. This may have interfered with their illness severity and diminished the ophthalmological findings. Despite this, the clinic receives patients with psoriasis from a wide catchment area, ensuring greater diversity of cases. Second, the extensive exclusion criteria might have led top us missing patients who could have affected the final results. However, this was either unavoidable or required to mitigate against potential confounders.

In conclusion, there is a higher prevalence of dry eye, probable dry eye, and blepharitis in patients with psoriasis. We recommend that these patients undergo periodic eye examinations to monitor for ocular manifestations that might otherwise progress asymptomatically, regardless of typical risk factors (e.g., arthropathic and nail psoriasis, or severity indices). Including ocular screening in psoriasis management protocols could help achieve early diagnosis and improve outcomes.

REFERENCES

1. Papp KA, Langley RG, Sigurgeirsson B, Abe M, Baker DR, Konno P, et al. Efficacy and safety of secukinumab in the treatment of moderate-to-severe plaque psoriasis: a randomized, double-blind, placebo-controlled phase II dose-ranging study. Br J Dermatol. 2013;168(2):412-21.
2. Sabat R, Philipp S, Höflich C, Kreutzer S, Wallace E, Asadullah K, et al. Immunopathogenesis of psoriasis. Exp. Dermatol. 2007; 16(10):779-98.
3. Moghaddassi M, Shahram F, Chams-Davatchi C, Najafizadeh SR, Davatchi F. Different aspects of psoriatic arthritis: analysis of 150 iranian patients. Arch Iranian Med. 2009;12(3):279-83.
4. Karabulut AA, Yalvac IS, Vahaboglu H, Nurozler AB, Duman S. Conjunctival impression cytology and tear-film changes in patients with psoriasis. Cornea. 1999;18(5):544-8.
5. Martins GA, Arruda L, Mugnaini AS. Validation of life quality questionnaires for psoriasis patients. An Bras Dermatol. 2004; 79:521-35.
6. Prigol AM, Tenório MB, Matschinske R, Gehlen ML, Skare T. Translation and validation of ocular surface disease index to Portuguese. Arq Bras Oftalmol. 2012;75(1):24-8.

7. 2007 Report of the International Dry Eye Workshop (DEWS). Ocul Surf. 2007;5(Spec Issue):65-199.
8. Sullivan BD, Whitmer D, Nichols KK, et al. An objective approach to dry eye disease severity. Invest Ophthalmol Vis Sci. 2010;51(12): 6125-30.
9. Van Bijsterveld OP. Diagnostic tests in the Sicca syndrome. Arch Ophthalmol. 1969;82(1):10-4.
10. Schiffman MS. Reliability and Validity of the Ocular Surface Disease Index. Arch Ophthalmol. 2000;118(5):615-21.
11. Kilic B, Dogan U, Parlak AH, Goksugur N, Polat M, Serin D, et al. Ocular findings in patients with psoriasis. Int J Dermatol. 2013; 52(5):554-9.
12. Catsarou-Catsari A, Katsambas A, Theodoropoulos P, Stratigos J. Ophthalmological manifestations in patients with psoriasis. Acta. Derm. Venereol. 1984;64(6):557-9.
13. Lima FB, Abalem MF, Ruiz DG, Gomes Bde A, Azevedo MN, Moraes HV Jr, et al. Prevalence of eye disease in Brazilian patients with psoriatic arthritis. Clinics. 2012;67(3):249-53.
14. Gomes JA, Alves MR. Superfície ocular: córnea, limbo, conjuntiva, filme lacrimal. 2nd ed. Rio de Janeiro (RJ): Guanabara Koogan; 2011.
15. Kapıcıoglu Z, Bahadır S, Memis Ö, Erdöl H, Ağaoğlu C, Gül U, et al. Psoriasis olgularında oküler tutulum. T Klin Dermatol. 1996; 6(3):118-20.
16. Zengin N, Tol H, Balevi S, Gündüz K, Okudan S, Endoğru H.Tear film and meibomian gland functions in psoriasis. Acta Ophthalmol Scand. 1996;74(4):358-60.
17. Knox DL. Psoriasis and intraocular inflammation. Trans Am Ophthalmol Soc. 1979;77:210-44.
18. Garreis F, Gottschalt M, Schlorf T, Gläser R, Harder J, Worlitzsch D, et al. Expression and regulation of antimicrobial peptide psoriasin (S100A7) at the ocular surface and in the lacrimal apparatus. Invest Ophthalmol Vis Sci. 2011;52(7):4914-22.
19. Broome AM, Ryan D, Eckert RL. S100 protein subcellular localization during epidermal differentiation and psoriasis. J Histochem Cytochem. 2003;51(5):675-85.
20. Jäger K, Garreis F, Posa A, Dunse M, Paulsen FP. Functional relationship between cationic amino acid transporters and beta-defensins: implication for dry skin diseases and the dry eye. Ann Anat. 2010;192(2):65-9.
21. Her Y, Han SH, Cho HL, Lim JW. Tear film changes and ocular surface characteristics in patients with psoriasis vulgaris. Korean J Dermatol. 2012;50(10):855-9.
22. Erbagci I, Erbagci Z, Gungor K, Beckir N. Ocular anterior segment pathologies and tear film changes in patients with psoriasis vulgaris. Acta Med Okayama. 2003;57(6):299-303.
23. Campanati A, Neri P, Giuliodori K, Arapi I, Carbonari G, Borioni E, et al. Psoriasis beyond the skin surface: a pilot study on the ocular involvement. Int Ophthalmol. 2015;35(3):331-40.
24. Her Y, Lim JW, Han SH. Dye Eye and tear film functions in patients with psoriasis. Jpn J Ophthalmol. 2013;57(4):341-6.
25. Liu S, Richards SM, Lo K, Hatton M, Fay A, Sullivan DA. Changes in gene expression in human meibomian gland dysfunction. Invest Ophthalmol Vis Sci. 2011;52(5):2727-40.
26. Begley CG, Chalmers RL, Abetz L, Venkataraman K, Mertzanis P, Caffery BA, et al. The relationship between habitual patient-reported symptoms and clinical signs among patients with dry eye of varying severity. Invest Ophthalmol Vis Sci. 2003;44:4753-61.
27. Nichols KK, Nichols JJ, Mitchell GL. The lack of association between signs and symptoms in patients with dry eye disease. Cornea. 2004;23(8):762-70.
28. Elder JT, Nair RP, Henseler T, Jenisch S, Stuart P, Chia N, et al. The genetics of psoriasis 2001. Arch Dermatol. 2001;137(11):1447-54.
29. Chandran NS, Greaves M, Gao F, Lim L, Cheng BC. Psoriasis and the eye: prevalence of eye disease in Singaporean Asian patients with psoriasis. J Dermatol. 2007;34(12):805-10.
30. Taborda ML, Weber MB, Teixeira KA, Lisboa AP, Welter EQ. Evaluation of quality of life and psychological distress of patients with different dermatoses in a dermatology referral center in the South. An Bras Dermatol. 2010;85(1):52-6.
31. Schiepers OJ, Wichers MC, Maes M. Cytokines and major depression. Prog Neuropsychopharmacol Biol Psychiatry. 2005; 29(2):201-17.
32. Herbert VG, Lögering B, Von Gruben V, Filev F, Klemm M, Reich K. Ulcerative keratitis in psoriasis: a rare variant of psoriatic ocular inflammatory disease. Br J Dermatol. 2014;170(3):735-58.