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EVALUATIONS OF THE CORNEAL PARAMETERS IN SUBJECTS HAVING RHEUMATOID ARTHRITIS

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ABSTRACT

Background: A reduction in the corneal thickness (CT) is reported in subjects having rheumatoid arthritis (RA), as shown in existing literature data. However, the literature evidence is scarce concerning the evaluation of anterior chamber parameters, CV (corneal volume), and keratometric values.

Aim: The present study aimed to evaluate the corneal parameters in subjects having rheumatoid arthritis.

Methods: The study assessed 128 subjects with rheumatoid arthritis where 64 subjects were given biologic 64 subjects were given conventional drugs and 64 subjects were healthy controls. Corneal volume, corneal thickness from thinnest point (TCT), apex (ACT), and from pupil center (CCT), and keratometry values (mean keratometry [Km]), steep [K2], and anterior flat [K1]) were evaluated and compared between the groups.

Results: The study results showed significantly higher Km, K1, and K2 values in the RA group with p=0.02, 0.04, and 0.01 respectively. Mean values of CV, TCT, ACT, and CCT were significantly lower in RA subjects with p=0.01, <0.001, <0.001, and <0.001 respectively. On dividing RA subjects into 2 groups concerning the treatment and compared to controls, differences in CV, TCT, ACT, CCT, and K1 were significant with p=0.03, 0.001, 0.005, and 0.03 respectively. CV and K1 values of the RA-biologic group were similar to controls with p=0.125 and 0.203.

Conclusions: The present study concludes that biologic agents lead to improvement in corneal volume and keratometric values in subjects with rheumatoid arthritis.

Keywords: Corneal thickness, corneal volume, keratometry, rheumatoid arthritis, corneal parameters

INTRODUCTION

Rheumatoid arthritis or RA is a disease that affects the joints and is an inflammatory, autoimmune, and multisystemic disease mainly affecting synovial joints. Rheumatoid arthritis affects nearly 1% of the population globally and is nearly threefold higher in females compared to male subjects. The onset of rheumatoid arthritis is usually between the age of 40 and 50 years. Rheumatoid arthritis also affects the eyes, skin, kidneys, lungs, and heart along with the synovial joints. In subjects with rheumatoid arthritis, ocular involvement is seen in nearly 25% of the subjects.[1] In ocular involvement, dry eye is the most common concern that develops owing to the ocular surface involvement. Apart from dry eyes, retinal vasculitis, anterior

uveitis, scleritis, episcleritis, and corneal inflammatory diseases including corneal melting, peripheral ulcerative keratitis, sclerosing keratitis, and stromal keratitis can also be seen in rheumatoid arthritis subjects.[2]

The stroma layer composed of regularly arranged collagen fibers is vital in refractive power, flexibility, and corneal transparency. While aging results in stromal changes as natural processes, pathological conditions such as systemic connective tissue diseases can also affect the corneal stroma. It is vital to measure the corneal parameters to understand the degree of ocular involvement in these diseases. It has been reported that rheumatoid arthritis is the most prevalent autoimmune disease that damages the cornea. The type of affected collagen, amount of corneal hydration, and extracellular matrix involvement can differ in various types of autoimmune diseases with corneal involvement.[3,4]

Assessment of corneal parameters helps in providing valuable information in glaucoma suspicion, evaluation of refractive disorders, follow-up of keratoconus, and intraocular lens power is vital in assessing these parameters. However, a decrease in CT (corneal thickness) in subjects with rheumatoid arthritis has been seen in various studies, there are scarce studies in the literature assessing anterior chamber parameters, CV (corneal volume), and keratometry values.[5] The present study was aimed at the corneal parameters in subjects having rheumatoid arthritis including anterior anterior chamber measurements as chamber angle (ACA), anterior chamber depth (ACD), anterior chamber volume (ACV) along with corneal parameters as CV, CT (central, apex, thinnest), and keratometry.

MATERIALS AND METHODS

The present prospective clinical study was aimed at the corneal parameters in subjects having rheumatoid arthritis including anterior chamber measurements such as chamber angle (ACA), anterior chamber depth (ACD), anterior chamber volume (ACV) along with corneal parameters such as CV, CT (central, apex, thinnest), and keratometry. The study was done at Department of Ophthalmology, SMBT Institute of Medical Sciences and Research Centre, Dhamangaon, Nashik, Maharashtra. Verbal and written informed consent were taken from all the subjects before study participation.

The study included subjects with rheumatoid arthritis who presented to the Institute within the defined study period. The present study included 128 subjects against 64 age-matched healthy controls. Subjects with rheumatoid arthritis were then divided into 2 groups depending on the treatment where Group I comprised 64 subjects with rheumatoid arthritis that were given therapy as biological DMARDs (disease-modifying anti-rheumatoid drugs) and Group II comprised 64 rheumatoid arthritis subjects that were given conventional DMARDs.

In participating subjects, the right eye was assessed. For diagnosis, ACR/EULAR (American College of Rheumatology/ European League Against Rheumatism) 2010 criteria were used. Exclusion criteria for the study were contact lens wearers, usage of any topical medication except artificial tears, history of ocular trauma or surgery, refractive errors of more than ± 3.00 D, and presence of any systemic or ophthalmic disease (except dry eye).

In all the subjects, demographic data were assessed including the presence of dry eyes, disease duration, gender, and age of the subjects. Also, the DAS-28 (disease activity scores) of rheumatoid arthritis subjects were assessed. DAS-28 scores were assessed from 28 tender and swollen joint counts, patient global score, and C-reactive protein. Scores of <2.6 showed remission of rheumatoid arthritis, 2.6-3.2 showed low disease activity, and 3.2-5.1 showed active disease, whereas, >5.1 showed very active disease.

Mean keratometry (Km), steep (K2), and anterior flat (K1) were assessed using a high-resolution imaging system. Other parameters assessed were chamber parameters including ACA, ACD, ACV, CV, CT from pupil center (CCT), thinnest point (TCT), and apex (ACT). In the darkness, Scheimpflug camera scans were performed. The scans were approved as OK based on QS (quality specification) as accepted for analysis. The same person blinded to groups performed all measurements simultaneously. Data from rheumatoid arthritis subjects and healthy subjects were compared between the groups.

The data gathered were analyzed statistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, one-way ANOVA (analysis of variance), and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

The present prospective clinical study was aimed at the corneal parameters in subjects having rheumatoid arthritis including anterior chamber measurements such as chamber angle (ACA), anterior chamber depth (ACD), anterior chamber volume (ACV) along with corneal parameters such as CV, CT (central, apex, thinnest), and keratometry. The study assessed 128

subjects with rheumatoid arthritis where 64 subjects were given biologic and other 64 subjects were given conventional drugs and other 64 subjects that were healthy controls. Dry eyes were absent/present in 92/36 subjects from the RA group, mean DAS-28 scores were 3.32±1.31 in the RA group, and the mean RA duration was 13.69±9.74 years. There were 110/18 males/females in the RA group and 50/14 males/females in the controls showing statistical non-significance with p=0.336. The mean age of the study subjects was comparable in RA and controls with p=0.094 (Table 1).

The study results showed that for comparison of demographic and disease data of RA biologic and RA conventional subjects, dry eyes were seen in 46/18 subjects from Group I and II respectively with p=1.000. Mean DAS-28 scores were 3.56±1.44 and 3.08±1.13 in Group I and II subjects respectively which was statistically non-significant with p=0.203. Mean RA duration was 14.70±9.58 and 12.68±9.94 years in Groups I and II which was statistically non-significant with p=0.11. There were 50/14 males/females in Group I and 60/4 males/females in Group II showing statistical non-significance with p=0.073. The mean age of the study subjects in Groups I and II was statistically non-significant with p=0.574 (Table 2).

It was seen that for comparison of various corneal parameters in study subjects, Km was significantly higher in the RA group compared to controls with p=0.02 and was statistically comparable in Groups I and II with p=0.06. K1 was significantly higher in RA subjects compared to controls with p=0.01 and in Group II compared to me with p=0.03. K2 was significantly higher in RA groups compared to controls with p=0.04 and showed a non-significant difference in Groups I and II with p=0.101. CV was significantly higher in controls compared to the RA group with p=0.01 and in Group I compared to Group II with p=0.03. TCT was significantly higher in controls compared to the RA group with p<0.001 and in Group I compared to II with p=0.001. ACT was significantly higher in controls compared to the RA group and in Group I compared to Group II with p<0.001 and 0.001. CCT was also significantly higher in controls compared to RA and in Group I compared to Group II with p<0.001 and 0.005. ACA, ACD, and ACV were comparable in RA and controls, and Groups I and II showed no statistical difference (Table 3).

On comparing the results in the post-hoc analysis, CV was statistically non-significant in Group I-II with p=0.841 and was non-significant in Group I-control with p=0.125 and Group II-control showed significant results with p=0.03. TCT was statistically non-significant with p=0.777 and was significant in Group I-controls and Group II-controls with p=0.012 and 0.001. Similar results were seen for ACT which was non-significant in Group I-control with p=0.611 and was significant in Group I-controls and Group II-controls with p=0.014 and 0.001. CCT was non-significant in Group I-control with p=0.563 and was significant in Group I-controls and Group II-controls with p=0.008 and 0.001. For K1, it was non-significant in Group I-II and Group I-control with p=0.614 and 0.203 and was significant in Group II-control with p=0.02 (Table 4).

DISCUSSION

The present study assessed 128 subjects with rheumatoid arthritis where 64 subjects were given biologic and other 64 subjects were given conventional drugs and other 64 subjects that were healthy controls. Dry eyes were absent/present in 92/36 subjects from the RA group, mean DAS-28 scores were 3.32±1.31 in the RA group, and the mean RA duration was 13.69±9.74 years. There were 110/18 males/females in the RA group and 50/14 males/females in the controls showing statistical non-significance with p=0.336. The mean age of the study subjects was comparable in RA and controls with p=0.094. These data were comparable to the studies of Sedaghat MR et al[6] in 2012 and Taş M et al[7] in 2014 where authors assessed subjects with demographics and disease data comparable to the present study.

It was seen that for comparison of demographic and disease data of RA biologic and RA conventional subjects, dry eyes were seen in 46/18 subjects from Group I and II respectively with p=1.000. Mean DAS-28 scores were 3.56±1.44 and 3.08±1.13 in Group I and II subjects respectively which was statistically non-significant with p=0.203. Mean RA duration was 14.70±9.58 and 12.68±9.94 years in Groups I and II which was statistically non-significant with p=0.11. There were 50/14 males/females in Group I and 60/4 males/females in Group II showing statistical non-significance with p=0.073. The mean age of the study subjects in Groups I and II was statistically non-significant with p=0.574. These results were consistent with the studies of Can ME et al[8] in 2015 and Gunes A et al[9] in 2015 where a comparison of demographic and disease data of RA biologic and RA conventional subjects therapy group similar to the present study was reported by the authors in their respective studies.

The study results showed that for comparison of various corneal parameters in study subjects, Km was significantly higher in the RA group compared to controls with p=0.02 and was statistically comparable in Groups I and II with p=0.06. K1 was significantly higher in RA subjects compared to controls with p=0.01 and in Group II compared to me with p=0.03. K2 was significantly higher in RA groups compared to controls with p=0.04 and showed a non-significant difference in Groups I and

II with p=0.101. CV was significantly higher in controls compared to the RA group with p=0.01 and in Group I compared to Group II with p=0.03. TCT was significantly higher in controls compared to the RA group with p<0.001 and in Group I compared to II with p=0.001. ACT was significantly higher in controls compared to the RA group and in Group I compared to Group II with p<0.001 and 0.001. CCT was also significantly higher in controls compared to RA and in Group I compared to Group II with p<0.001 and 0.005. ACA, ACD, and ACV were comparable in RA and controls, and Groups I and II showed no statistical difference. These findings were in agreement with the results of Özcura F et al[10] in 2017 and Gurlevik U et al[11] in 2020 where the authors suggested a comparison of various corneal parameters in RA and control groups in their studies as seen in the results of the present study.

Concerning the comparison of the results in the post-hoc analysis, CV was statistically non-significant in Group I-II with p=0.841 and was non-significant in Group I-control with p=0.125 and Group II-control showed significant results with p=0.03. TCT was statistically non-significant with p=0.777 and was significant in Group I-controls and Group II-controls with p=0.012 and 0.001. Similar results were seen for ACT which was non-significant in Group I-control with p=0.611 and was significant in Group I-controls and Group II-controls with p=0.014 and 0.001. CCT was non-significant in Group I-control with p=0.563 and was significant in Group I-controls and Group II-controls with p=0.008 and 0.001. For K1, it was non-significant in Group I-II and Group I-control with p=0.614 and 0.203 and was significant in Group II-control with p=0.02. These results correlated with the findings of Boote C et al[12] in 2009 and Amador-Patarroyo MJ et al[13] in 2018 where similar results to the present study were reported by the authors in their respective studies.

CONCLUSIONS

Considering its limitations, the present study concludes that biological agents lead to improvement in corneal volume and keratometry values in subjects with rheumatoid arthritis. However, further future longitudinal studies with larger sample sizes and longer monitoring periods are needed to reach a definitive conclusion.

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Parameters	RA group (n=128)	Controls (n=64)	p-value
Dry eyes present/absent	92/36	-	-
Mean DAS-28 scores	3.32±1.31	-	-
Mean RA duration (years)	13.69±9.74	-	-
Gender (males/females)	110/18	50/14	0.336
Mean age (years)	57.57±9.28	54.01±10.66	0.094

Table 1: Demographic and disease data of control and RA subjects

Parameters	Group I (RA biologic) (n=64)	Group II (RA conventional) (n=64)	p-value
Dry eyes present/absent	46/18	46/18	1.000
Mean DAS-28 scores	3.56±1.44	3.08±1.13	0.203
Mean RA duration	14.70±9.58	12.68±9.94	0.411
Gender (males/females)	50/14	60/4	0.073
Mean age (years)	58.23±9.42	56.91±9.22	0.574

Table 2: Comparison of demographic and disease data of RA biologic and RA conventional subjects

Variables	RA (n=64)	Controls (n=64)	p-value	Group I	Group II	p-value
Km	44.47±1.82	43.62±1.53	**0.02**	44.29±1.63	44.66±2.00	0.062
K1	44.03±1.73	43.11±1.49	**0.01**	43.83±1.49	45.23±1.94	**0.03**
K2	44.91±2.02	44.13±1.63	**0.04**	44.72±1.84	44.10±2.13	0.101
CV (mm3)	57.54±4.26	59.80±3.40	**0.01**	57.82±5.28	57.26±2.98	**0.03**
TCT (µm)	513.54±31.62	540.70±34.33	**<0.001**	516.29±37.19	510.79±25.16	**0.001**
ACT (µm)	520.50±29.85	547.14±34.02	**<0.001**	524.20±33.36	516.79±25.87	**0.001**
CCT (µm)	519.23±32.63	546.39±34.14	**<0.001**	523.00±33.13	515.11±24.12	**0.005**
ACA	34.48±6,96	36.21±7.71	0.268	35.86±7.71	33.09±5.93	0.167
ACD (mm)	2.87±0.69	2.89±0.52	0.912	2.91±0.67	2.84±0.71	0.897
ACV (mm3)	137.73±37.04	147.26±33.15	0.222	143.29±40.42	132.17±33.03	0.223

Table 3: Comparison of parameters in different study groups

S. No		Group I-II	Group I-control	Group II-control
1.	**CV**	0.841	**0.125**	**0.03**
2.	**TCT**	0.777	**0.012**	**0.001**
3.	**ACT**	0.611	**0.014**	**0.001**
4.	**CCT**	0.563	**0.008**	**0.001**
5.	**K1**	0.614	0.203	**0.02**

Table 4: comparison of results in post-hoc analysis