

Changes in Optical Coherence Tomography Angiography after Suprachoroidal Triamcinolone Acetonide injection in Diabetic patients

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ABSTRACT

Background: Diabetic macular edema (DME) is a leading cause for loss of central vision in diabetics with retinopathy. Treatment approaches for DME have shifted away from Laser therapy as the first line of therapy for DME.

Aim and objectives: to investigate the changes in Optical coherence tomography angiography (OCT-A) after suprachoroidal injection of triamcinolone acetonide (SCTA) in patients with diabetic macular edema.

Patients and Methods: This a prospective case series study that was conducted on twenty eyes with refractory diabetic macular edema who treated with single suprachoroidal injection of triamcinolone acetonide. All patients underwent history taking, ocular examination and optical coherence tomography angiography (OCT-Angiography).

Results: there was no statistically significant difference between the studied groups as regard (Relation between baseline, third month and sixth month LogMAR BCVA), (Relation between baseline, third month and sixth month CFT (Central foveal thickness)), (Relation between baseline, third month, sixth month SVD (superficial vessel density) and sixth month DVD (Deep vessel density)), (Relation between baseline, third month and sixth month FAZ (Foveal avascular zone) in mm) and (Correlation between BCVA at six month and (CFT, SVD, DVD, FAZ) at six months).

Conclusion: our findings suggest that SCTA may be an effective treatment option for diabetic macular edema, improving visual outcomes and reducing retinal thickness.

Key words: Optical Coherence Tomography Angiography, Suprachoroidal Triamcinolone Acetonide injection, Diabetic patients.

INTRODUCTION

Diabetic macular edema (DME) occurs due to chronic hyperglycemia, poor glycemic control is one of the major risk factors of DME. The incidence of DME over a 10 years period is 20% in patients with younger onset diabetes versus approximately 40% in patients with older onset diabetes. Its risk factors are duration of Diabetes Mellitus (DM) poor control with prolonged elevated hemoglobin A1C (HbA1c), Hypertension, Hyperlipidemia and Kidney disease [1].

Anti-vascular endothelial growth factor (anti-VEGF) agents have demonstrated remarkable efficacy in several pivotal clinical trials for control of centre-involving DME, and have become the gold standard primary treatment replacing laser photocoagulation. However, there remains a sizeable proportion of eyes with persistent DME that is resistant to anti-VEGF agents despite strict study protocols [2].

There are many anti-vascular endothelial growth factors (Anti- VEGF) agents as (Eylea®, Bayer, Leverkusen, Germany - Lucentis®, Novartis, Basel, Switzerland & Avastin®, Genentech Inc., San Francisco, CA, USA) that are in use for treating DME. Despite their approval by Food and Drug Administration (FDA), not all patients are responsive to this therapy [3].

The use of locally given steroids has proven their efficacy in certain clinical situations as first line of treatment e.g., DME with pseudophakic eyes responds equally well to steroids and ranibizumab as illustrated by Protocol I of Diabetic Retinopathy Clinical Research Network (DRCR.net) [4].

Optical coherence tomography angiography (OCT-A) is a new diagnostic non-invasive method by which the vascular structures of the retina and choroid can be visualized three-dimensionally without need for using fluorescence dyes or mydriasis. The technology of OCT-A is an advancement of the OCT. By means of more powerful software and hardware used for OCT-A not only morphological but also retinal and choroidal vascular perfusion analyses can be performed [5].

This new technology allows the in situ, high-resolution visualization of the individual vascular layers. In contrast to fundus fluorescein angiography (FFA), which displays only the superficial capillary network, OCT-A aids in the visualization of the superficial, deep and choroidal vascular network; even the middle capillary plexus could be identified [6].

The aim of this work was to study the changes in Optical coherence tomography angiography (OCT-A) after suprachoroidal injection of triamcinolone acetonide (SCTA) in diabetic patients with diabetic macular edema.

PATIENTS AND METHODS

This was a prospective case series study conducted to study the changes in Optical coherence tomography angiography (OCT-A) after suprachoroidal injection of triamcinolone acetonide (SCTA) in diabetic patients with diabetic macular edema.

The study included Diabetic patients with resistant diabetic macular edema who were treated by

suprachoroidal injection of triamcinolone acetate (SCTA). They were recruited from Ophthalmology department in Benha University Hospital during the period from January 2022 to January 2023.

Twenty eyes with refractory diabetic macular edema treated with suprachoroidal injection of triamcinolone acetate.

Refractory diabetic macular edema (DME) is typically diagnosed based on clinical assessment and imaging findings by OCT.

Inclusion criteria: Age (18-70 years), either phakic or pseudophakic eyes, Type I and II DM and Refractory DME with central foveal thickness (CFT) more than 300um.

Exclusion criteria: Patients with dense cataract or vitreous hemorrhage interfering with OCT-A imaging, High-risk Proliferative diabetic retinopathy, Any posterior segment pathology other than diabetic retinopathy that could affect retinal thickness and dence of vitreomacular traction (VMT) by OCT.

Methodology

All patients were subjected to Detailed clinical history tacking, Ocular Examination (Best Corrected Visual Acuity (BCVA), Measurement of Intraocular Pressure (IOP), Anterior Segment Assessment by Slit Lamp Examination and Fundus Examination with Slit-Lamp Biomicroscopy with +90 Lens and Indirect Ophthalmoscopy) and Optical coherence tomography angiography (OCT-Angiography) (Preparation, Procedure and Image Interpretation and Analysis)

Ethical considerations

The study was approved by the Ethical Committee of Faculty of Medicine, Ophthalmology department Benha University Hospital. There are adequate provisions to maintain privacy of participants and confidentiality of the data

Statistical analysis

The collected data was revised, coded, and tabulated using the Statistical package for Social Science (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY:

IBM Corp.). Data were presented and suitable analysis was done according to the type of data obtained for each parameter. Visual acuity results were converted to equivalent LogMAR for statistical analysis.

RESULTS

The mean age (years) (50.60± 5.86), and most of cases were females (75%). [Table 1]

There was statistically significant difference between baseline, third month and sixth month regarding BCVA. There was no statistically significant difference between Baseline and Third month and no statistically significant difference between third month and Sixth month regarding BCVA. [Table 2]

There was statistically significant difference between baseline, third month and sixth month regarding CFT. CFT was significantly higher among baseline than third month. CFT was significantly higher among baseline than sixth month. CFT was significantly higher among third month than sixth month. [Table 3]

There was no statistically significant difference between baseline,third month and sixth month regarding SVD. There was no statistically significant difference between baseline, third month and sixth month regarding DVD. [Table 4]

There was statistically significant difference between baseline, thirdmonth and sixth month regarding FAZ. There was no statistically significant difference between Baseline and Third month regarding FAZ. FAZ was significantly lower among baseline than sixth month. FAZ was significantly lower among Third month than Sixth. [Table 5]

This table shows that, there was statistically significant negative correlation between BCVA at sixth month and both CFT and SVD at sixthmonth while there was no statistically significant correlation between BCVA at sixth month and other variables. There was no significant difference between baseline andpost injection IOP when measured. IOP increased about 1 mmHg three months post injection and decreased about 0.5 mmHg six months post injection. [Table 6]

Table (1) Demographic data among the studied cases.

		Mean ± SD	
Age (years)		50.60± 5.86	
Sex	Female	No.	%
	Male	15	75.0
		5	25.0

Table (2) Relation between baseline, third month and sixth monthLogMAR BCVA.

	Baseline	Third month	Sixth month	F.test	P. value	LSD	Mean changesbetween six month and baseline
	Mean±SD	Mean±SD					
BCVA	.184± .164	.131± .106	.097± .059	32.804	.000	P1=0.232 P2=0.032 P3=0.218	-0.087

BCVA=Best corrected visual acuity, F.test= statistical test with F-distribution, LSD= Least significant difference

P1 between Baseline and Third month, p2 between Baseline and Sixth month, p3 between Third month and Sixth month.

Table (3) Relation between baseline, third month and sixth month CFT(Central foveal thickness).

	Baseline	Third month	Sixth month	F.test	P.value	LSD	Mean changes between six month and baseline
	Mean ±SD	Mean±SD					
CFT(μm)	558± 189	317.80± 68.36	274.50± 66.23	1270.947	.000	P1=0.000 P2=0.000 P3=0.049	-283.5

CFT=Central foveal thickness, F.test= statistical test with F-distribution, LSD= Least significant difference

P1 between Baseline and Third month, p2 between Baseline and Sixth month, p3 between Third month and Sixth month.

Table (4) Relation between baseline, third month, sixth month SVD (superficial vessel density) and sixth month DVD(Deep vessel density).

	Baseline	Third month	Sixth month	F.test	P.value	Mean changes between six month and baseline
	Mean ±SD	Mean± SD				
SVD	38.50± 5.77	38.34± 4.66	39.13± 4.13	1344.210	.089	0.63
DVD	36.81± 6.88	38.06± 6.32	38.58± 4.57	3.435	.099	1.77

SVD= superficial vessel density, F.test= statistical test with F-distribution.

Table (5) Relation between baseline, third month and sixth month FAZ(Foveal avascular zone) in mm.

	Baseline	Third month	Sixth month	F.test	P.value	LSD	Mean changes between six month and baseline
	Mean ±SD	Mean± SD					
FAZ	.261± .082	.299± .059	.359± .069	25.174	.000	P1=0.101 P2=0.000 P3=0.005	0.098

FAZ=foveal avascular zone, F.test= statistical test with F-distribution, LSD= Least significant difference

P1 between Baseline and Third month, p2 between Baseline and Sixth month, p3 between Third month and Sixth month.

Table (6) Correlation between BCVA at six month and (CFT, SVD,DVD, FAZ) at six months.

	Pearson's correlation	
	r	P
SIXTH M. CFT * SIXTH BCVA	-0.702-	0.001
SIXTH M. SVD * SIXTH BCVA	-0.433-	0.046
SIXTH M. DVD * SIXTH BCVA	-0.275-	0.240
SIXTH M. FAZ * SIXTH BCVA	-0.225-	0.341

BCVA=best corrected visual acuity, CFT=central foveal thickness, DVD=deep vessel density, FAZ=foveal avascular zone, SVD=superficial vessel density.

CASE PRESENTATION

Case no.1: Female patient 51 years old with right resistant DME underwent suprachoroidal injection of triamcinolone acetonide (SCTA).

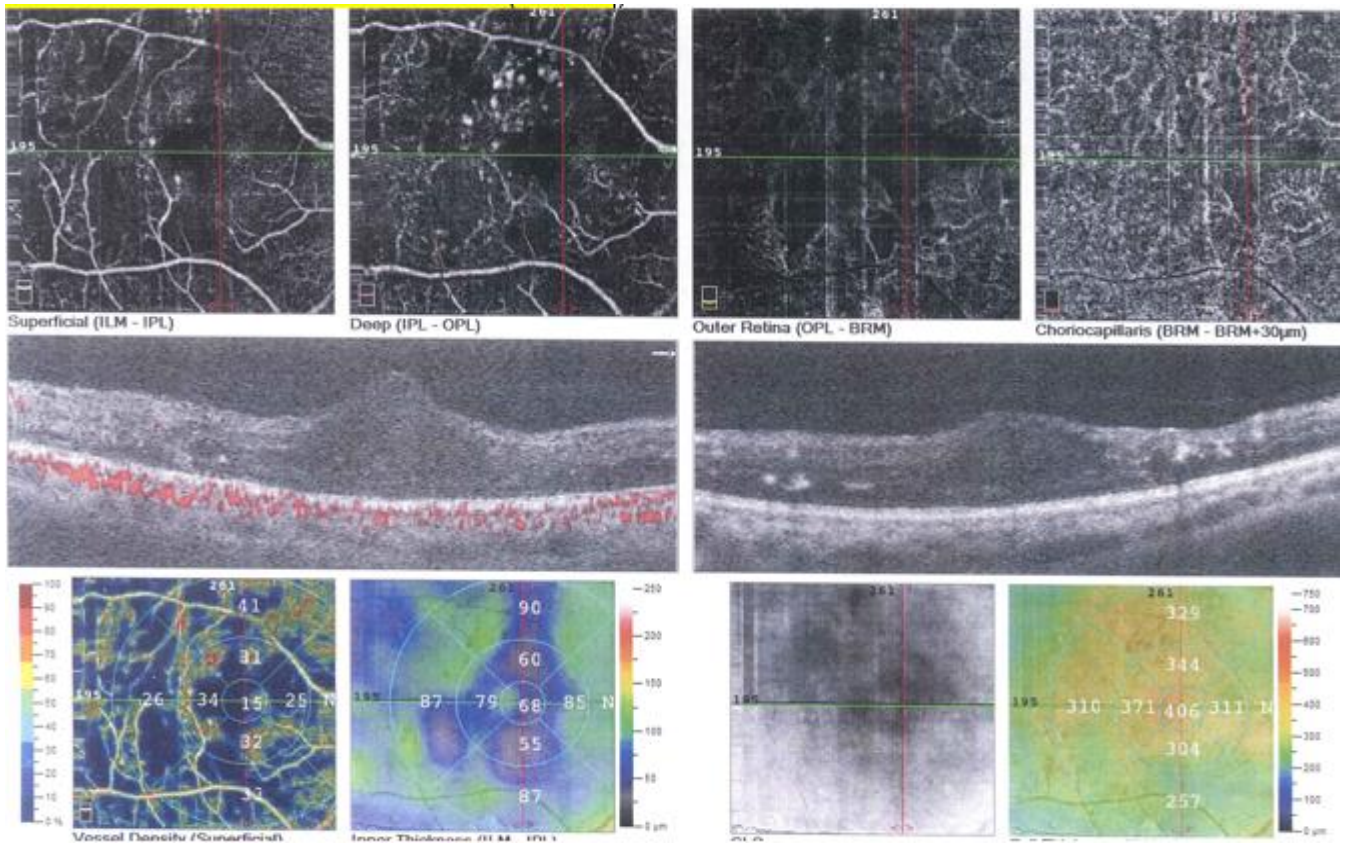


Fig. (1) Base line OCT-A showing CFT 406 μm .

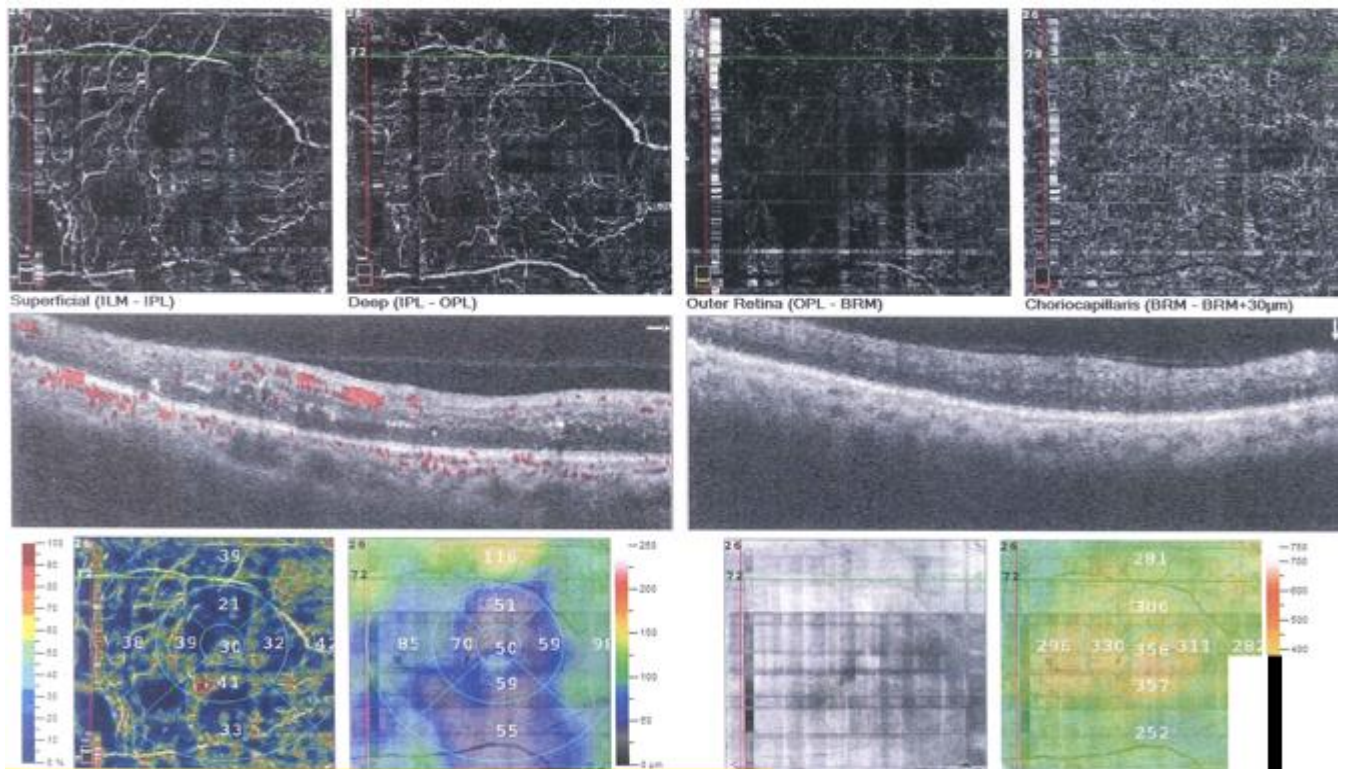


Fig. (2) Third mont OCT-A showing CFT 358 μm .

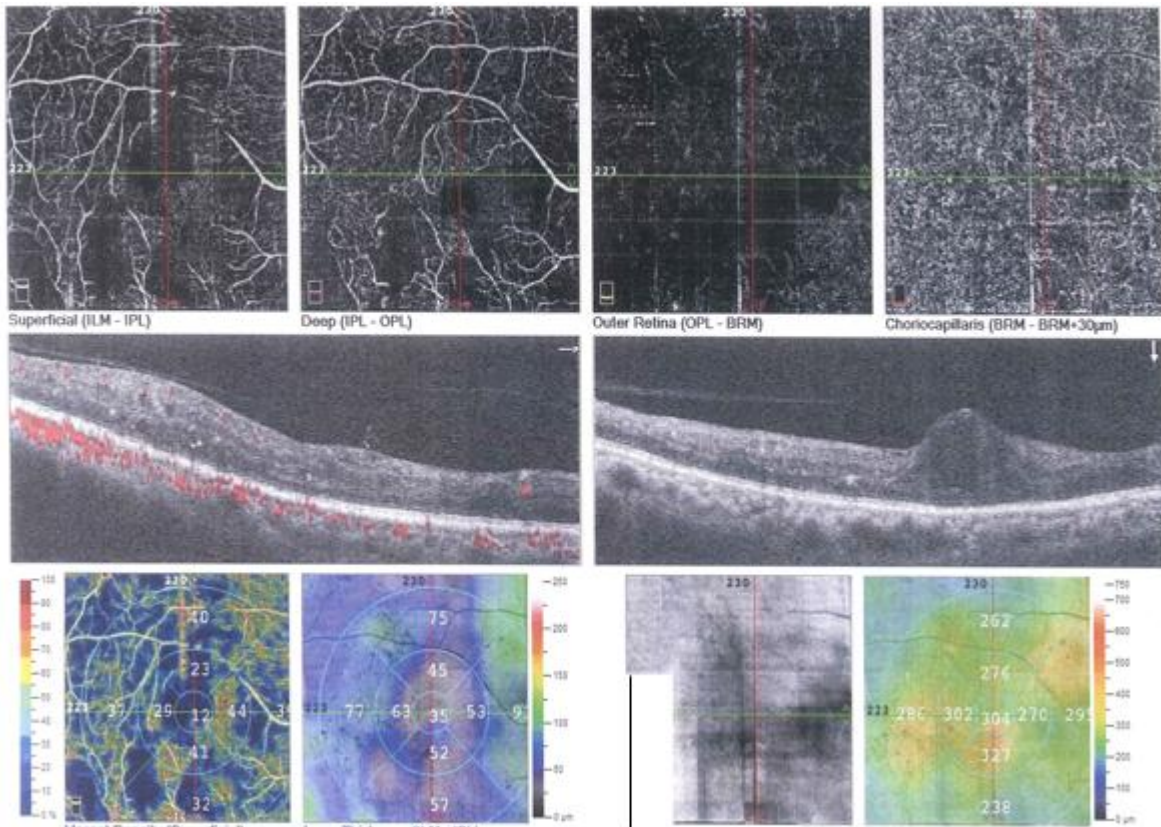


Fig. (3) Sixth month OCT-A showing CFT 304 μ

DISCUSSION

Diabetic macular edema (DME) is the leading cause of visual loss in those with diabetic retinopathy and is increasing in prevalence globally. The prevalence of DME in patients with diabetic retinopathy is 2.7%–11% and it varies based on the type of diabetes and the duration of the disease, but for both types 1 and 2 after 25-years duration, it approximates 30%. Systemic factors associated with DME include longer duration of diabetes, higher systolic blood pressure, and higher hemoglobin A1C. The sole ocular factor associated with DME is diabetic retinopathy severity as increasing severity is associated with increasing prevalence of DME [7].

In this study, the mean age (years) (50.60 ± 5.86), and 75% of cases were female while 25% of them were male. The sample is evenly split between left eyes and right eyes, with 10 cases having a left eye and 10 cases having a right eye.

In the current study, there was statistically significant difference between baseline, third month and sixth month regarding BCVA. There was no statistically significant difference between Baseline and Third month and between third month and Sixth month regarding BCVA.

Similarly, Sacconi et al., retrospectively evaluated 44 eyes (30 patients): 15 eyes (15 patients) affected by pseudophakic cystoid macular edema (PCMO); 14 healthy fellow eyes used as negative control group; 15 eyes (15 age-matched and sex-matched patients) with DME used as positive control group. Using OCT-A, it

was found that a strong response to the treatment was observed: BCVA was significantly different between baseline and after treatment ($P=0.023$) [8].

Also, Blinder et al., evaluated the efficacy, safety, and injection frequency of vascular endothelial growth factor (VEGF) inhibitors as used in clinical practice for the treatment of diabetic macular edema. Multicenter (10 sites), retrospective chart review in patients ($n=156$) who received ≥ 3 anti-VEGF injections. Mean change from baseline BCVA after each of the first 6 anti-VEGF injections was statistically significant ($P<0.001$) and ranged from +1.0 to +1.3 lines [9].

According to our results, there was a statistically significant difference between baseline, third month and sixth month regarding CFT. CFT was significantly higher among baseline than third month. CFT was significantly higher among baseline than sixth month. CFT was significantly higher in the third month than sixth month.

Moreover, Chan et al., found that the standard deviation of the mean thickness of each sector outside the central 1000- μ m diameter was consistently approximately 15 μ m, demonstrating little variability in thickness measurements by OCT. The SDs of 20 and 23 μ m for mean foveal thickness and mean central foveal thickness, respectively, were slightly larger [10].

In the present study, there was no statistically significant difference between baseline, third month and sixth month regarding SVD. There was no statistically significant difference between baseline, third month and sixth month regarding DVD.

In consistent with our results, Zhang et al., demonstrated that SVD and DVD did not significantly differ between the two groups before and after intravitreal aflibercept [11].

Our study showed there was statistically significant difference between baseline, third month and sixth month regarding FAZ. There was no statistically significant difference between Baseline and Third month regarding FAZ. FAZ was significantly lower among baseline than sixth month. FAZ was significantly lower among Third month than sixth month. The explanation of increased FAZ among some cases over the 6 months of follow-up in the current study, that there is a proliferative diabetic changes in some cases that will need augmented pan-retinal laser photocoagulation (PRP).

In the current study, there was statistically significant negative correlation between BCVA at sixth month and both CFT and SVD at sixth month while there was no statistically significant correlation between BCVA at sixth month and other variables.

Luo et al., enrolled 35 eyes of 35 patients with macular edema secondary to BRVO. They concluded that with six-month treatment, there was no correlation between BCVA and CFT ($P=0.506$) [12].

Moreover, Sacconi et al., concluded that no significant correlation was found between BCVA and FAZ area of both SCP and DCP in patients with PCMO ($P=0.091$ and $P=0.37$, respectively) and between CMT and FAZ area ($P=0.32$ and $P=0.13$, respectively). No significant correlation was found between BCVA and VD in all groups [8].

Sheth et al., (2022) evaluated correlations between variability in central foveal thickness (CFT) and vision with ranibizumab in a HARBOR post hoc analysis. There was a correlation between larger CFT fluctuations through month 12 and lower gains in BCVA at month 24, with quartile 4 at month 12 having LSM changes from baseline in BCVA of 4.7 (95% CI 1.9 to 7.5) vs 10.4 (95% CI 8.4 to 12.5) in quartile 1 [13].

In our study mean IOP at baseline was 15 ± 2 mmHg and at 3 months follow up it was 15.5 ± 2 and at six months it was 15 ± 2 while in HULK Study mean IOP was 13.8 mmHg at baseline and it was 14.214.2 mmHg at six months of HULK trial. HULK study reported two patients with IOP rose from 19 to 24 mmHg at one month and required Anti Glaucoma treatment while in another study the authors reported no increase in IOP after SCTA [14].

CONCLUSION

In conclusion, suprachoroidal injection of triamcinolone acetonide (SCTA) in diabetic patients with resistant diabetic macular edema resulted in significant improvements in visual acuity (BCVA) and reduction in central foveal thickness (CFT). However, there were no significant changes observed in superficial vessel density (SVD) and deep vessel density (DVD). Foveal avascular zone (FAZ) showed significant

reductions at the third and sixth months compared to baseline. Furthermore, BCVA at the sixth month exhibited a significant negative correlation with both CFT and SVD.

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