

## Comparative Study between Pre and Post Intravitreal Injection of Triamcinolone Acetonide Regarding RNFL Thickness in Macular Oedema by OCT

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### Abstract

**Purpose:** To evaluate the efficacy of pre and post intravitreal Triamcinolone acetonide injection used in treatment of macular oedema (diabetic and complicating vein occlusion) on RNFL thickness as evaluated by OCT.

**Patient and method:** 53 eyes were included in this study with macular oedema with age 50 - 65 years where RNFL thickness measured before treatment of macular oedema and RNFL thickness measured for the same eyes after treatment by single intravitreal Triamcinolone injection (4mg in 0.1 ml . RNFL thickness was evaluated by OCT pre and at an interval of 3 months post-injection in this group and the changes in RNFL thickness was compared.

**Results:** The mean RNFL thickness did not change significantly after a single injection of intravitreal TA for treatment of patients with macular oedema.

Mean average, inferior, superior, nasal and temporal RNFL thickness pre injection was 91.63 +/-10.5, 118.9 +/- 19.95, 104.57 +/- 15.3, 76.33 +/- 10.8 and 69.13 +/- 10.26. Mean average, inferior, superior, nasal and temporal RNFL thickness post injection was 90.83 +/- 10.11, 111.8 +/- 19.95, 103.8 +/- 15.03, 76.00 +/- 11.7 and 69.9 +/- 10.3.

**Conclusion:** In short term, comparing pre and pos intravitreal Triamcinolone injection single dose used to treat macular oedema on the thickness of RNFL, didn't lead to significant changes on RNFL thickness despite the possibility of intra-ocular pressure fluctuation.

**Keywords:** RNFL Thickness; OCT; Comparison; Intravitreal Triamcinolone; Macular Oedema

### Abbreviations

IVTA: Intra-Vitreous Triamcinolone; RNFL: Retinal Nerve Fiber Layer; OCT: Optical Coherent Tomography; TD: Time Domain; CME: Cystoid Macular Oedema; DR: Diabetic Retinopathy; PP: Peri Papillary; CFT: Central Foveal Thickness

### Introduction

Macular oedema is a common condition that is usually associated with underlying disease process. It is most commonly seen following diabetic retinopathy; venous occlusive disease and posterior segment inflammatory disease as well as intra-ocular surgery. It may develop in a diffuse pattern or it may acquire the characteristic petaloid appearance referred to as cystoid macular oedema (CME) [1].

There have been a variety of approaches to the treatment of macular oedema. Intravitreal injection of Triamcinolone Acetonide has been used in treatment of macular oedema [2].

The most common adverse effects associated with intravitreal steroid injection are elevation of intra-ocular pressure, progression of cataract, endophthalmitis, pseudo-endophthalmitis and rarely retinal detachment [3].

Multiple studies have shown that there is transient IOP elevation associated with intra-ocular injections the effect of these intravitreal injections on RNFL thickness is related to neurotrophic properties of injected dye as well as IOP fluctuation. Many studies investigate the change in RNFL thickness by OCT using the standard fixed diameter circular scan centered around the optic disc in patient treated by intravitreal injection of Triamcinolone [4].

Previous studies have suggested a possible relationship between foveal edema and pp-RNFL, but the result was not quite satisfactory Kim J., *et al.* [5], however, because of some possible individual discrepancy between foveal edema and peripapillary edema, it is now believed to discuss more direct relation with the pp-RNFL [6].

The recently developed OCT provides the ophthalmologist with the opportunity to customize scans and to tailor a single scan circle to examine RNFL thickness. Custom scans can be useful to help the ophthalmologist differentiate normal from early affected peripapillary RNFL.

## **Material and Methods**

The study included 53 eyes with established diagnosis of macular oedema of various etiologies (diabetic and vein occlusion) mainly diabetic, with no previous treatment. and the study was done at ophthalmic diagnostic laser unit, Kasr El Ainy, faculty of medicine, Cairo university.

### **Exclusions criteria**

- Patients with macular oedema who had received treatment.
- Patient with ischemic maculopathy, vitreo-macular traction and proliferative retinopathy.
- Patients with any form of optic disc lesion or any other pathology.

Full ophthalmic and systemic histories were taken to detect/ exclude ophthalmic and systemic diseases.

All eyes undergone full ophthalmological examination and certain investigations (FFA and OCT) prior to injection then at an interval of 3 months following single injection of the drug.

An informed consent was obtained from all patients after discussing the potentials benefits and risks of intra-vitreous injection.

Fundus Fluorescein Angiography was done to document and confirm macular oedema and to exclude the presence of any proliferative retinopathy or ischemic maculopathy.

Optical coherence tomography was done for assessment of macular oedema, evaluation of RNFL thickness, and to exclude vitreo-macular traction disorders.

Testing was done by OTI OCT machine which is a time domain machine (TD-OCT-512 A- scan in 1.28 second).

The used protocol for RNFL thickness assessment is the RNFL thickness acquisition protocol in which each eye was scanned 3 times using a circle size of 3.4 mm around the optic nerve, judged to be of acceptable quality and image stored for each eye tested. Each scan consists of 512 individual A-scans and the mean of the three scans was used for the result. RNFL thickness is quantified by an automated computer algorithm that identifies the anterior and posterior borders of RNFL. The data are presented by clock hours, by quadrants and overall. Thus obtained data were identified as mean total RNFL thickness, temporal, superior, nasal and inferior thickness measurements. Thicknesses were displayed in 3 different colors. The green, yellow and red areas are determined by comparing the patient's RNFL thickness values with those of a normative database. The green representing the 95% normal range (Figure 1) yellow (borderline classification) representing values outside the 95% confidence interval but within the 99% confidence interval of normal distribution and the red (outside normal limits) represents values outside the 99% confidence interval of normal distribution.

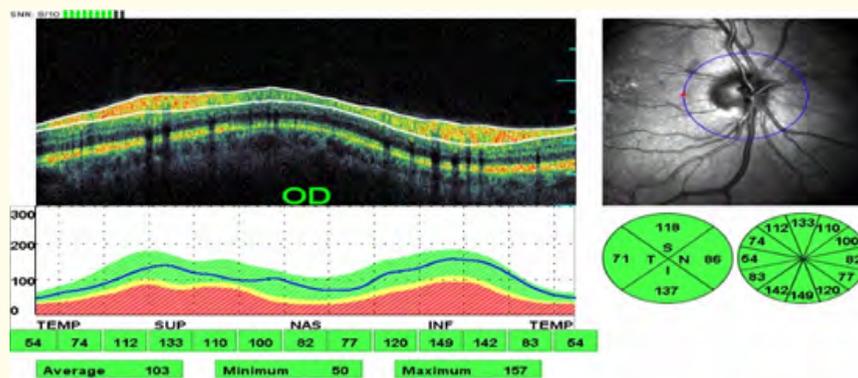


Figure 1: Normal RNFL thickness analysis by OTI OCT machine using a 3.4 mm circle centered around the optic disc.

## Results

Our study included 53 eyes with macular oedema were eyes showed different types of macular oedema that fit the inclusion criteria were included and RNFL thickness measured before macular oedema was treated (pre-injection). And again measured 3 months after macular oedema was treated by single intravitreal Triamcinolone injection (4 mg in 0.1 ml).

The study included patients aged between 50 - 65 years mean (60.80 +/- 5.73).

Mean RNFL thickness had not changed significantly after a single injection of intravitreal TA (Figure 2).

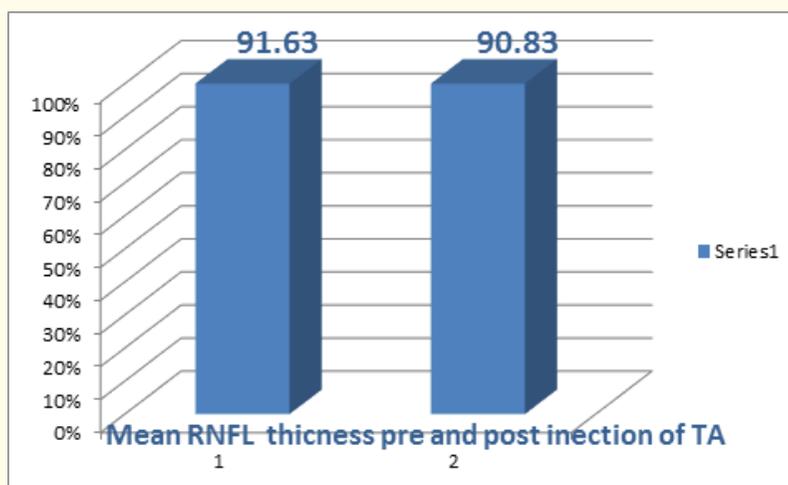
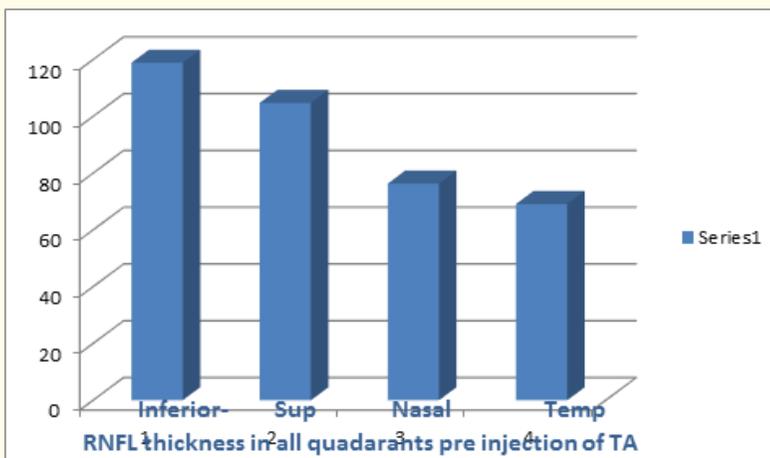


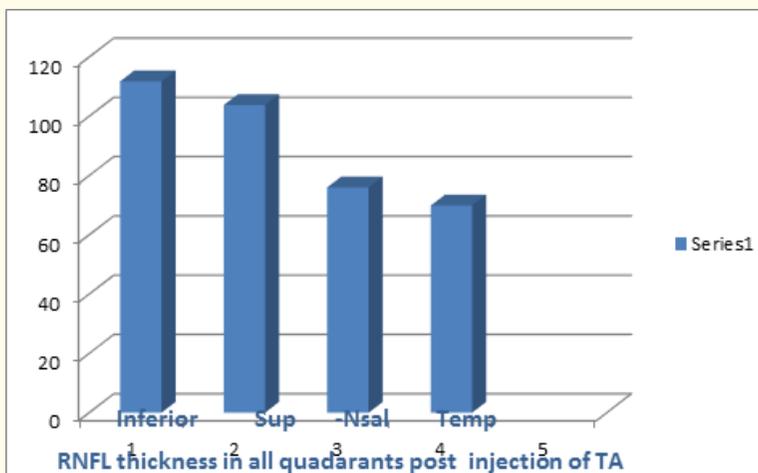
Figure 2: Mean average RNFL thickness before and after injection.

Regarding RNFL thickness measured before treatment average, inferior , superior , nasal and temporal RNFL thickness pre injection was 118.9 +/- 19.95, 104.57 +/- 15.3, 76.33 +/- 10.8 and 69.13 +/- 10.26 (Figure 3).



**Figure 3:** Inferior, superior, nasal and temporal RNFL thickness pre TA injection 118.9 +/- 19.95, 104.57 +/- 15.3, 76.33 +/- 10.8 and 69.13 +/- 10.26.

Regarding measurement after single injection the average, inferior, superior, nasal and temporal RNFL thickness post injection was 111.8 +/- 19.95, 103.8 +/- 15.03, 76.00 +/- 11.7 and 69.9 +/- 10.3.9 (Figure 4).



**Figure 4:** Inferior, superior, nasal and temporal RNFL thickness post TA injection 111.8 +/- 19.95, 103.8 +/- 15.03, 76.00 +/- 11.7 and 69.9 +/- 10.3.9.

Thus the difference between average, inferior, superior, nasal and temporal RNFL thicknesses before and after intra-vitreous Triamcinolone injection was statistically insignificant with p value = 0.388, 0.098, 0.426, 0.457.

### Discussion

In this study we evaluated the effect of intravitreal Triamcinolone Acetonide to treat macular oedema on RNFL thickness as measured by OCT pre injection and at an interval of 3 months post injection.

Also the effect of intravitreal Triamcinolone Acetonide on RNFL thickness pre and post injection was evaluated individually at the same interval. The used doses for Triamcinolone were 4 mg and our measurement included those after single injection and measurements were done after 3 months post injection and showed no significant change for RNFL thickness after single injection.

Consistent with some results obtained by Kriechbaum, *et al.* [7], we observed that intravitreal Triamcinolone is also effective in reducing Central Foveal Thickness (CFT) and improving visual acuity in macular oedema at 3 months follow up.

Along the course of our study 5 cases treated by intravitreal Triamcinolone developed transient elevation of IOP which was controlled medically, IOP returned to baseline level and medication was discontinued. This was in agreement with the results obtained by Bakri and Beer [8], who reported that the increase in IOP was found in 27.9% of patient after single 4 mg intravitreal Triamcinolone injection and this elevation was transient.

This increase of IOP showed us that other alternative intravitreal injections may not result in increase IOP as some previous studies showed and no statistical difference between pre and post injections regarding IOP measurements in patient treated by Bevacizumab. This was confirmed previously by Shimura, *et al.* [9], who found that injection of Bevacizumab had the advantage of IOP stability compared with Triamcinolone treated eyes.

Also repeated intra-vitreous injection of Bevacizumab doesn't seem to have adverse effect on IOP in cases of intravitreal injection in macular oedema away from any changes of RNFL thickness that did not happen in our study too [10].

Against our study were the results concluded by Ulas, *et al.* [11], who found that short term intravitreal TA lead to significant decline in RNFL thickness before and after injection (p value was 0.022).

Cataract progression was detected in one patient in with (Triamcinolone treated). The incidence of cataract progression in our study was similar to the rate observed by Jonas *et al.*, 3.8% [12].

When comparing Triamcinolone Acetonide effect on RNFL thickness where our study concluded that there was no significant difference in RNFL thickness post injection, however other similarly studies that comparing Bevacizumab as an alternative intravitreal injection also showed no significant difference in RNFL thickness post injection as ULas, *et al.* [11], concluded that Bevacizumab lead to no significant change in RNFL thickness (p value = 0.135) and previously by Horsley, *et al.* [4], who demonstrated that intravitreal Bevacizumab was nontoxic to optic nerve and long term treatment with anti-VEGF didn't lead to significant change in OCT RNFL thickness, despite the possibility of some IOP fluctuation after intravitreal injection.

### Conclusion

In conclusion from this study, RNFL thickness was not significantly affected in patient with macular oedema after treated by single intravitreal Triamcinolone Acetonide injection. Also there was no significant difference between RNFL thickness pre and 3 months post injection.

Since most macular oedema are usually not treated by a single injection but by repeated injection, the effect of repeated intravitreal injection on RNFL thickness should be evaluated. Also the results would likely have been different if we used a higher dose of intravitreal TA (8 mg/0.2 ml) and intravitreal Bevacizumab (2.5 mg/0.1 ml) instead of the used doses.

Furthermore a longer period of follow up is needed to assess the safety and/or efficacy of treatment.

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