



# CORRELATION BETWEEN EYE APERTURE DIAMETER AND COMPLICATIONS IN THE POSTERIOR EYE SEGMENT AFTER ND-YAG CAPSULOTOMY

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## ABSTRACT

The aim of our research was to explore possible correlation between eye aperture diameter and occurrence of complications in the posterior eye segment after Nd-YAG capsulotomy. In the study, we analyzed 120 eyes of the patients who experienced opacities in the posterior capsule or developed secondary cataract after the surgery. All patients underwent Nd-YAG laser posterior capsulotomy. Thereafter, we monitored complications occurrence in the posterior eye segment in intervals of one hour, seven days, one month and six months following the surgery. The frequency of complications increased with time. Six months after Nd-YAG laser posterior capsulotomy we found changes in the posterior eye segment: hole in the anterior hyaloid membrane in case of 9 (7,50%) eyes, prolapse of the corpus vitrei in 2 (1,66%) cases, retinal hole in case of 5 (4,16%) eyes, macular hole in 3 (2,50%) eyes, retinal detachment in 3 (2,50%) eyes, cystoid macular edema in 2 (1,66%) eyes, (1,66%), and macular pack in case of 11 (9,16%) eyes. Aperture size in the posterior capsule directly correlates with the number of complications. We suggest that the aperture diameter should not exceed 4,0 mm.

KEY WORDS: Nd YAG laser capsulotomy, aperture size, complications

## INTRODUCTION

With the development of modern implantation microsurgery techniques for cataract, the frequency of opacities in the posterior capsule has increased. The opacities mentioned collect on the implanted lens or posterior capsule. A reticule or membrane can be formed in the papillary zone, significantly reducing visual function. The incidence of opacities ranges from 18 to 50% (1). They usually occur in the first year after surgery, and may develop much later, up to five years after the surgery (2). The aperture in the posterior capsule is created by laser beam, making the optic media transparent. Short-term concentration of great energy causes microcarbonization of the tissue followed by a „shock wave“. These two synergetic mechanisms momentarily transform the focused material (3,4). After Nd-YAG laser capsulotomy, the following complications may occur in the posterior eye segment: hole in the anterior hyaloid membrane (5), prolapse of the corpus vitrei (6), retinal detachment (7), retinal hole (6,7), macular hole (4), cystoid macular edema (8), macular pack (4) and rarely endophthalmitis (9). Our first aim is to determine the frequency of complications in the posterior eye segment following Nd-YAG capsulotomy. The following aim is to investigate possible correlation between the frequency of complications and diameter of aperture in the posterior capsule.

## PATIENTS AND METHODS

The investigation is conducted as prospective, clinical, manipulative, controlled study in the duration of eighteen months. In the study, we monitored 120 eyes of the patients at the Eye Clinic of the Sarajevo University Clinics Center, who experienced opacities in the posterior capsule or developed secondary cataract after the surgery. All patients underwent Nd-YAG laser posterior capsulotomy. During the investigation we have collected: ophthalmologic anamnesis, definition of refraction, measurement of intraocular pressure, examination of the anterior and posterior segment in binocular biomicroscopy. Using laser beam apertures of various diameters were created in the posterior capsule. On the basis of aperture diameter patients were divided into four groups:

	Aperture diameter
<b>I group</b>	<b>3,0-3,5 mm</b>
<b>II group</b>	<b>3,6-4,0 mm</b>
<b>III group</b>	<b>4,1-4,5 mm</b>
<b>IV group</b>	<b>4,6-5,0 mm</b>



FIGURE 1. Laser capsulotomy

The intervention was performed using the equipment YAG Carl Zees, which creates a laser beam with wavelength of 1064 nm. (Figure1). The procedure was performed in topical anesthesia using drops of Tetracaine, with pupil in semimydrisis. The basic statistics was computed using methods of descriptive statistics: mean, standard deviation, mode, median, minimum and maximum. Among exact tests we used Chi-square test, Fischer exact test and Pearson correlation matrix.

## RESULTS AND DISCUSSION

Following the gender analysis we established higher frequency of female patients (53%) (Chart 1).

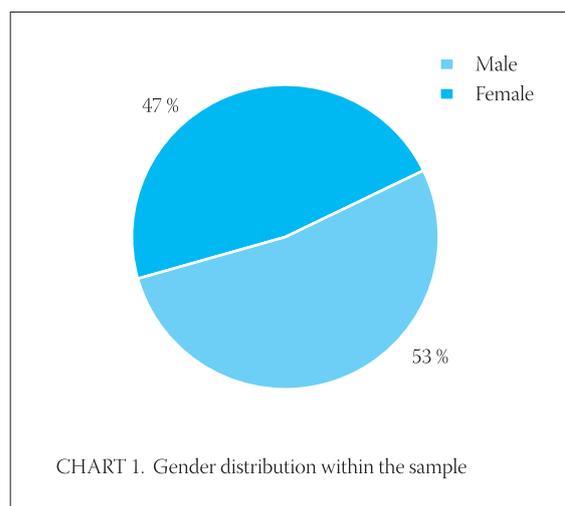


CHART 1. Gender distribution within the sample

Patients	X	SD	Median	Mode	Min.	Max.
120	65,2	9,62	66	65	13	88

TABLE 1. Vital statistics

Patients age ranged from only 13 to 88 with average age around 65.2 years (Table 1).

We have analyzed the complications in the posterior eye segment, which occurred in the observed time

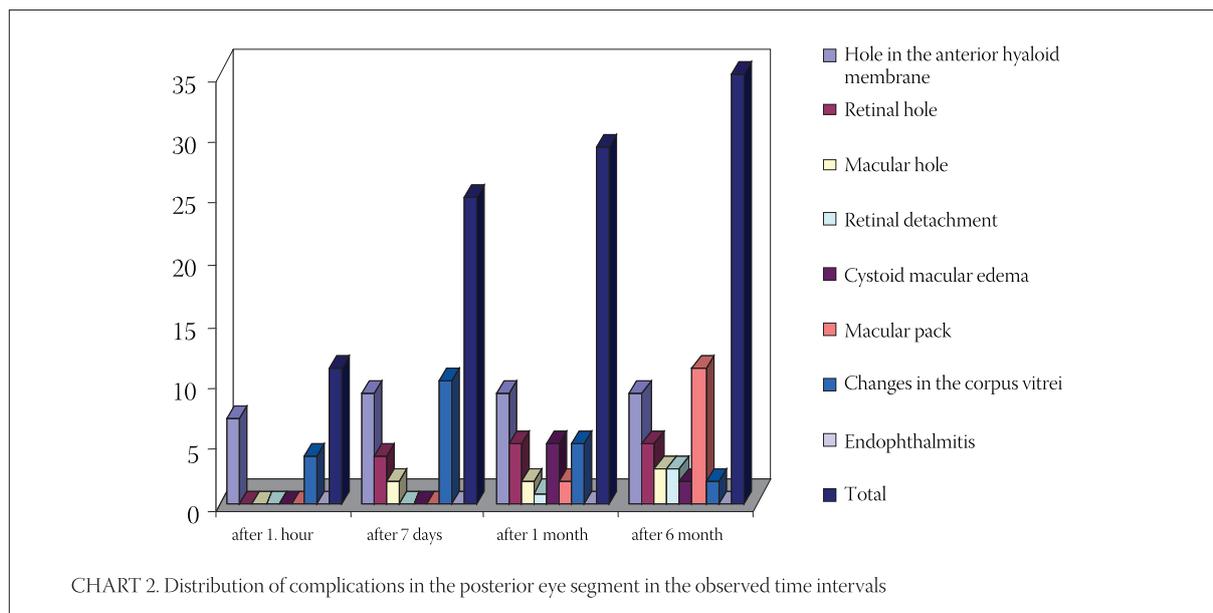


CHART 2. Distribution of complications in the posterior eye segment in the observed time intervals

period: one hour after laser capsulotomy, then, after one week, one month and six months. The rupture of the anterior hyaloid membrane, which is a dominant complication in the posterior segment, was found in 9 (7,50%) cases. After one week we noticed significant changes in corpus vitrei in the form of different opacities in 10 (8,33%) cases. Cystoid macular edema occurred as a characteristic complication after one month in 5 (4,16%) cases. Also, in this time period first retinal ruptures occurred in 5 (4,16%) and maculae developed in 2 (1,66%) cases. Six months following capsulotomy macular fibrosis was the most often complication and was present in 11 (9,16%) cases (Chart 2). Usually one month after the capsulotomy, we noticed retinal rupture with incidence of 2,5% (7). Chances for occurrence of retinal ruptures are two-fold greater in cases of patients that did not undergo YAG laser capsulotomy (10). They may be situated at all meridians including macula, but their most frequent localization is upper temporal square (6). In our research we had 3 (2,50%) cases of macular hole after six months. Macular holes after capsulotomy are consequences of the direct damage caused by laser beam during thermal and mechanical disruption as well as changes in vitreous body (11-13). According to the recent findings macular holes are consequences of the tangential tractions which start from perifoveolar vitreous cortex (14,15). In our sample of 120 eyes we found retinal detachment following capsulotomy in 3 (2,50%) cases. In case of one patient it occurred after one month, and in other two cases, six months after capsulotomy. Patients after laser capsulotomy have 3,9 times greater chance to develop retinal detachment compared to those that did not undergo YAG laser capsulotomy (16). Cystoid

macular edema after laser capsulotomy occurred in 5 (4,16%) eyes during the first month after surgery. After six months it remained in 2 (1,66%) cases. All diagnosed macular edemas were treated locally with Dexametasonone and Indometacine, and systemically with vasodilatation medications and vitamins. The results of other studies reported that the cystoid macular edema following laser capsulotomy occurs during the first six months after the surgery with incidence of 0,5-4,9% (17). As previously mentioned, all eyes were classified into four groups according to the size of the aperture made by laser beam. We monitored the occurrence of complications in the posterior eye segment, and correlated aperture diameter with the frequency of complication in the observed time period (Table 2). When we analyzed the influence of aperture diameter on the complications in the first hour and one week following capsulotomy, we found it statistically significant ( $p=0,0375$  and  $p=0,009$  for  $\alpha=0,05$ ). In time, the significance diminished. In analysis of complications within group compared to the aperture diameter we can notice statistical significance among 1-3 ( $p=0,041$ ); 2-3 ( $p=0,013$ ); 4-5 ( $p=0,036$ ) group for  $\alpha=0,05$ . The largest number of complications was established in the group with aperture diameter between 4,1-4,5mm.

1 hour	7 days	1 month	6 months
$p = 0,0375$ s	$p = 0,0009$ s	$p = 0,2038$ ns	$p = 0,1645$ ns
$r = 0,9635$	$r = 0,8915$	$r = 0,8915$	$r = 0,7304$
1-3 $p = 0,041$ s	$\alpha = 0,05$	$\alpha = 0,05$	$\alpha = 0,05$
2-3 $p = 0,013$ s			
3-4 $p = 0,036$ s			
$\alpha = 0,05$			

TABLE 2. Influence of aperture diameter on complications during the period observed

There is a strong, positive correlation between number of complications and the aperture diameter ( $r=0,9635$ ). Aperture size can be discussed. Some authors state that smaller apertures are best prevention for retinal damage. Those in favor of diameter ranging

from 2-3 mm support this stand fewer complications, while others suggest larger aperture in capsule in order to improve vision (19). We had the best results in the case of 4,0 mm aperture diameter.

## CONCLUSION

Following laser capsulotomy complications can occur. The size of aperture in the posterior capsule is in direct correlation with the number of complications. We suggest that the aperture diameter should not exceed 4,0 mm.

### List of Abbreviations

Nd YAG            Neodymium Yttrium Aluminium Garnet

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