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นิพนธ์ต้นฉบับ **Original Article**

Comparison of the Post-operative Visual Outcomes between Contact Technique and Immersion Technique in Intraocular Lens Power Calculation

การเปรียบเทียบระดับสายตาหลังผ่าตัดด้วยการวัดเลนส์โดยวิธีสัมผัสและผ่านตัวกลาง

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ABSTRACT

Objectives: To compare the post-operative visual outcomes after cataract surgery between two methods of axial length measurement for intraocular lens power calculation: contact technique and immersion technique.

Material and methods: Records of axial length measurement were gathered from cataract patients undergoing surgery. The contact and immersion techniques were used on alternate days. SRK-II formula was used in all cases for intraocular lens power estimation. One month post-operative visual acuity of all patients in both groups were collected and statistically compared with chi-square test and Fisher's exact test.

Results: A total of 412 cataract patients were included in this study, 206 cases in each group. The demographic data and pre-operative visual acuity were comparable in both groups. At one month post-operation, the visual acuity in both techniques showed no statistically significant difference.

Conclusion: Contact and immersion techniques of axial length measurement for intraocular lens power calculation do not provide different results at one month post-operative visual acuity.

Keywords: intraocular lens power calculation, contact technique, immersion technique, axial length measurement, cataract surgery

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาเปรียบเทียบระดับสายตาหลังผ่าตัดต้อกระจก ระหว่างผู้ป่วยที่วัดเลนส์แก้วตาด้วยเทคนิค สัมผัสกับเทคนิค ผ่านตัวกลาง ว่ามีความแตกต่างกันหรือไม่

วัสดุและวิธีการ: วัดค่าความยาวลูกตาในผู้ป่วยที่จะทำผ่าตัดต้อกระจก ด้วยวิธีสัมผัส และวิธีผ่านตัวกลางโดยสลับกัน วันเว้นวัน ค่าที่ได้มาจะถูกคำนวณหากำลังเลนส์ตามสูตร SRK-II ทั้งสองวิธี

วัดระดับสายตาของผู้ป่วยทั้งสองกลุ่มหลังผ่าตัดครบ 1 เดือน นำผลที่ได้มาเปรียบเทียบทางสถิติเพื่อวิเคราะห์ว่ามีความแตกต่างกันหรือไม่ด้วย chi-square และ Fisher's exact test

ผลการศึกษา: ได้ประชากรเข้ามาในการศึกษาทั้งสิ้น 412 คน แบ่งเป็นวัดแบบสัมผัส และวัดแบบผ่านตัวกลางอย่างละเท่ากัน 206 ราย ไม่มีความแตกต่างกันของข้อมูลทางประชากรและระยะการมองเห็นก่อนผ่าตัด

ระดับสายตาหลังผ่าตัดอยู่ในเกณฑ์ดี และดีมากเป็นส่วนใหญ่ในทั้งสองกลุ่ม เมื่อวิเคราะห์เปรียบเทียบทางสถิติไม่พบว่ามีความแตกต่างกัน

สรุป: จากการศึกษานี้ พบว่าการวัดเลนส์แก้วตาด้วยวิธีแบบสัมผัส และแบบผ่านตัวกลาง มีผลต่อระดับสายตาหลังผ่าตัดไม่ต่างกัน

คำสำคัญ: การวัดเลนส์แก้วตาเทียม การวัดเลนส์แก้วตาเทียมแบบสัมผัส การวัดเลนส์แก้วตาเทียมแบบผ่านตัวกลาง การวัดความยาวลูกตา การผ่าตัดต้อกระจก

Introduction

Axial length is the most important factor to determine intraocular lens (IOL) power calculation.[1] An accurate axial length measurement makes the visual acuity outcomes predictable. There have been two methods to measure axial length with A-scan ultrasound: the contact technique and the immersion technique. Previously reported studies had shown that the axial length measured by contact technique was less than by immersion technique,[2-6] but some studies reported contrary results.[7]

At the out-patient department of the ophthalmology division, Nakhonpathom hospital, facilities of both contact technique and immersion technique for IOL calculation were available. Our well-trained personnel have used them without any practical problems. However, there have never been any studies in this institute reporting that which technique was more reliable and accurate in aspect of visual outcomes. So this study was designed to compare the visual acuity at one month after cataract surgery of patients, between contact and immersion technique for IOL calculation.

Material and Methods

The study protocol was approved by the ophthalmology division, Nakhonpathom hospital. All subjects gave consent before intraocular lens power measurement. Data were collected from cataract patients requiring surgery during 1st October 2010 to 30th December 2011. The patients with glaucoma, eye injury, corneal diseases, and retinal conditions

were excluded. Every patient received only one test of IOL calculations by an experienced measurer. The two techniques: contact and immersion, were alternately used on every other day. Only one eye from each patient was used in the study.

Measurement

Firstly, corneal curvatures were measured with TOPCON Auto ALK. In the contact technique, axial length was measured with ALCON OCUSCAN (Alcon Thailand), a 10-MHz probe and ultrasound velocities of 1532, 1641 and 1532 m/s for anterior chamber, lens and vitreous body. In the immersion technique, model US-500 (NIDEK) was used, a 10-MHz probe and ultrasound velocities of 1550, 1629 and 1532 m/s for anterior chamber, lens and vitreous body.

For the contact technique; patients were measured in supine position. The technician applied 1% Tetracaine hydrochloride on the affected eyes. The patients were asked to stare still in primary position, then the technician touched the ultrasound probe onto the cornea. The average of 10 reliable readings was accepted only if the standard deviation (S.D.) was less than 0.1 mm.

For the immersion technique: after 1% Tetracaine hydrochloride application, the technician inserted a scleral immersion shell with normal saline probe supporter into the patientís palpebral fissure and then asked the patients to fix their eyesight at the light probe. The equipment calculated the average of 10 reliable readings when the S.D. was less than 0.1 mm.

The SRK-II formula was used to calculate the IOL power in all cases.

Operations

Patients underwent phacoemulsification or extracapsular cataract extraction under the surgeons' decision upon the appropriate technique, depending on their cataract type.

Analysis

Visual outcomes of all patients were recorded by visual acuity measurement at one-month after operations. The visual acuity measurement was performed by an independent assistant who was unaware of the techniques used for axial length measurement. The data were statistically analyzed with chi-square test and Fisher's exact test.

Results

A total of 412 patients was enrolled in the study. The demographic data and baseline characteristics of the subjects in each group were comparable (Table 1). Pre-operative visual acuity of both groups was almost similar. The majority of subjects, approximately half of the patients in each group, had visual acuity in the range of 20/200 to 5/200 (Figure 1).

Post-operative results of both contact and immersion technique were excellent. Most patients achieved a very good visual acuity, i.e. in the range of 20/20 to 20/30, 57.8% in the contact technique group and 60.8% in the immersion technique group. The visual acuity of 20/40 to 20/50 was achieved in 21.4% in the contact technique group and 22.8%

Table 1 Demographic data and baseline characteristics of the patients in each group.

Characteristics	Contact technique group (n = 206)	Immersion technique group (n = 206)
Age in years (mean (S.D.)	64.1 (11.9)	63.9 (12.4)
Gender (Male:Female)	94:102	89:117
Pre-operative visual acuity		
Light Projection (PJ)	1	1
Light Perception (PL)	3	2
Hand Motion (HM)	17	9
Finger Counting (FC)	12	19
20/200-5/200	109	105
20/70-20/100	55	57
20/40-20/50	7	9
20/20-20/30	2	4

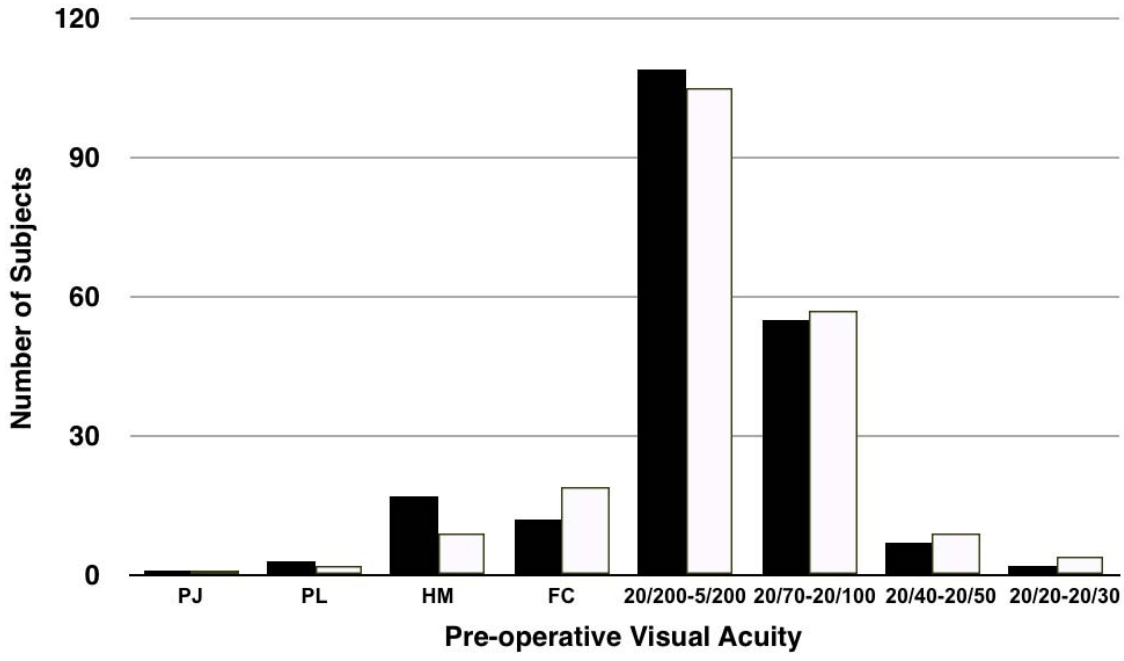

Figure 1 Pre-operative visual acuity

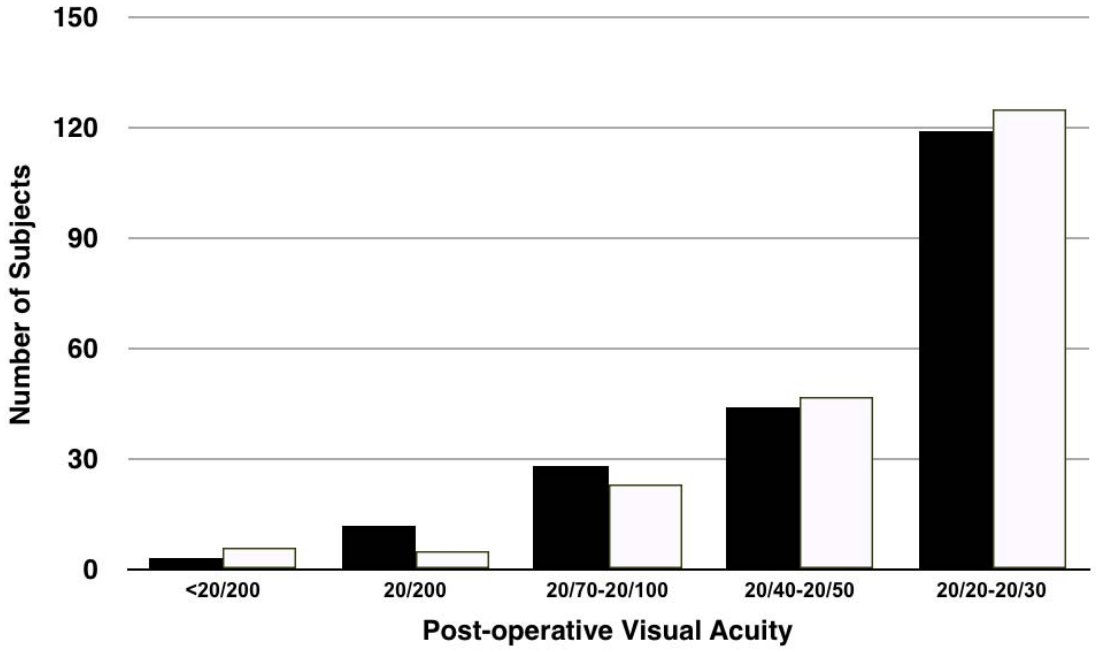

Figure 2 Post-operative visual acuity

in the immersion technique group (Figure 2). The post-operative visual acuity results in all ranges from both groups and the corresponding p-values are shown in Table 2

Discussion

The study was designed to compare the visual acuity outcomes from patients undergoing cataract surgery; one received contact technique and the other received immersion technique to obtain the axial length data and then to calculate the IOL power. Each patient was measured with only one technique and the results were from only one eye of each patient to avoid the dependency in the statistical analyses.

The demographic data and the baseline characteristics of both groups were almost similar thus we were quite fortunate to compare the post-operative results without necessity of statistical adjustment or using any co-variates.

The majority of the patients in each group obtained excellent post-operative visual acuity results (ranging from 20/20 to 20/50) at one month post operation, 79.1% in the contact technique group and 83.5% in the immersion technique group.

Hennessy et al[7] reported an average of 0.03 mm longer axial length with contact technique and thus proposed that the spring loaded ultrasound probe and a gentle technique should be used to eliminate significant indentation. The 0.03 mm of the axial length difference may result in 1.15

diopters of the IOL power, which may eventually distort the visual acuity results.

In this study, we did not use the proposed technique by Hennessy et al. Nevertheless, our patients obtained excellent post-operative outcomes from both techniques. We therefore postulate that the result may depend on the experience and competency of the measurer who has practiced more than 10 years in both techniques. This effect was also found by Kitthaweesin et al[8] who reported that, with high experience in both techniques, they did not find significant difference in axial length measurements, IOL power and post-operative visual acuity outcome consequences.

Conclusion

Our study did not find significant difference in the post-operative visual acuity results between the contact and immersion techniques of the axial length measurement for IOL power calculation. However, in the institutes where did not have immersion technique facility, contact technique IOL calculation was recommended, providing the same statistic visual outcomes if they recruited well trained measurer.

Acknowledgement

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