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Comparative analysis of early distance visual acuity in patients after coaxial phacoemulsification through the micro-incision (1.8 mm) and after standard phacoemulsification through the small incision (2.75 mm)

Analiza porównawcza wczesnej ostrości wzroku do dali u pacjentów po koaksjalnej fakoemulsyfikacji przez mikrocięcie (1,8 mm) i standardowej fakoemulsyfikacji przez małe cięcie (2,75 mm)

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Abstract:

Introduction: The purpose of the study was to evaluate early postoperative visual acuity outcomes of coaxial phacoemulsification with a foldable intraocular lens implantation, performed through a 1.8 mm wide clear corneal microincision (C-MICS) and to compare it with standard phacoemulsification through a 2.75 mm incision.

Material and methods: The examined group consisted of a non-randomised, prospective series of 130 eyes of 130 patients who underwent coaxial 1.8 mm microincision cataract surgery with foldable intraocular lens implantation (MI60®, Bausch & Lomb). The reference group comprised 123 eyes of 123 patients who underwent standard phacoemulsification through the 2.75 mm incision with foldable intraocular lens implantation (Akreos Adapt AO®, Bausch & Lomb). The following parameters were evaluated preoperatively and one day after the surgery: distance uncorrected visual acuity, distance best corrected visual acuity, intraocular pressure, anterior and posterior segment of the eye. All patients were divided into groups according to the LOCS III scale.

Results: The improvement of distance uncorrected visual acuity and distance best corrected visual acuity was observed postoperatively in both groups. The mean uncorrected visual acuity in the examined group was significantly better than in the reference group on the first postoperative day (0.88 ± 0.18 vs 0.79 ± 0.26).

Conclusions: The early postoperative visual acuity results of C-MICS were better than the results of standard small incision phacoemulsification. As far as fast visual rehabilitation after MICS is concerned, the early uncorrected visual acuity should be considered as an important yardstick in measuring success in cataract surgery.

These results are due to the MICS technique, which seems to be the minimally invasive surgery, and should be regarded nowadays as a procedure of choice.

Key words:

cataract, phacoemulsification, micro-incision, visual acuity.

Abstrakt:

Wstęp: celem pracy jest ocena wczesnej pooperacyjnej ostrości wzroku po koaksjalnej fakoemulsyfikacji z implantacją zwijalnej soczewki wewnątrzgałkowej, wykonywanej przez cięcie w czystej rogówce o szerokości 1,8 mm (C-MICS) i porównanie z wynikami standardowej fakoemulsyfikacji wykonywanej przez cięcie o szerokości 2,75 mm.

Materiał i metody: badanie miało charakter „nielosowy”, prospektywny i dotyczyło 130 oczu 130 pacjentów, którzy przebyli zabieg fakoemulsyfikacji koaksjalnej przez cięcie o szerokości 1,8 mm z implantacją wewnątrzgałkowej soczewki zwijalnej (MI60®, Bausch & Lomb). Grupę porównawczą tworzyło 123 pacjentów (123 oczu), u których wykonano standardową fakoemulsyfikację przez cięcie o szerokości 2,75 mm i wszczepiono zwijalną soczewkę wewnątrzgałkową (Akreos Adapt AO®, Bausch & Lomb). Przedoperacyjnie oraz w pierwszym dniu po zabiegu badano nieskorygowaną ostrość wzroku do dali, najlepiej skorygowaną ostrość wzroku do dali oraz ciśnienie wewnątrzgałkowe. Oceniano także przedni i tylny odcinek oka w biomikroskopie. Oczy wszystkich pacjentów podzielono na grupy według skali LOCS III.

Wyniki: nieskorygowana ostrość wzroku i najlepiej skorygowana ostrość wzroku do dali uległy po operacji poprawie u pacjentów z obu grup. Średnia nieskorygowana, pooperacyjna ostrość wzroku w pierwszym dniu po zabiegu była istotnie lepsza u pacjentów z grupy badanej niż u pacjentów z grupy porównawczej ($0,88 \pm 0,18$ vs $0,79 \pm 0,26$).

Wnioski: wyniki oceny wczesnej pooperacyjnej ostrości wzroku po koaksjalnej fakoemulsyfikacji przez mikrocięcie były lepsze od wyników standardowej fakoemulsyfikacji przez małe cięcie. Biorąc pod uwagę bardzo szybką rehabilitację pacjentów po operacjach przeprowadzanych przez mikrocięcie, wczesna nieskorygowana ostrość wzroku powinna być uznawana za ważne kryterium oceny czynnościowego sukcesu fakoemulsyfikacji. Takie wyniki są uzyskiwane dzięki technice C-MICS, która wydaje się operacją minimalnie inwazyjną i powinna być obecnie uważana za procedurę z wyboru.

Słowa kluczowe:

zaćma, fakoemulsyfikacja, mikrocięcie, ostrość wzroku.

Introduction

The goal of contemporary cataract surgery is not only to achieve good final visual acuity at least at one distance, but also quick rehabilitation, which is connected with good early postoperative uncorrected visual acuity (UCVA) and its stability. In the last few years very fast visual rehabilitation has become common, thanks to the introduction of micro-incision phacoemulsification (MICS), which was first defined by Alio as phacoemulsification performed through an incision of less than 2.0 mm (1, 2).

Cataract surgeons have developed two methods, which allow operating through micro-incision: the bimanual (B-MICS) and coaxial (C-MICS) techniques. Both methods make it possible to perform phacoemulsification and implant the intraocular lens (IOL) through a single micro-incision and they are recognized as a further step in cataract surgery development (3–6).

Purpose

The purpose of the study was to evaluate the early visual acuity outcomes of phacoemulsification with IOL implantation performed through a 1.8 mm wide clear corneal micro-incision (C-MICS) and to compare it with standard phacoemulsification (st. phaco) through a 2.75 mm incision.

Material and methods

The non-randomised, prospective series of patients after the uneventful phacoemulsification performed in our department between February and March 2012 were enrolled in the study. The study group (Group 1) consisted of 130 eyes of 130 patients, including 92 women (70.8%) and 38 men (29.2%) aged from 38 to 93 years (mean age of 72 ± 10.0 years), who underwent C-MICS. The control group (Group 2) consisted of 123 eyes of 123 patients, including 92 women (74.8%) and 31 men (25.2%), aged from 55 to 89 years (mean age of 75 ± 7.8 years), who underwent standard phaco.

The distance UCVA and best corrected visual acuity (BCVA) were assessed using standard Snellen charts. Autorefractometry, tonometry and biomicroscopy were performed before surgery and on the first post-operative day.

As the severity of nuclear sclerosis and cortical opacification in our patients differed, they were grouped according to LOCS III scale: LOCS 1-2, LOCS 3-4, LOCS 5-6. Mean LOCS III values were 3.30 ± 0.96 in Group 1 and 3.60 ± 1.10 in Group 2 ($p > 0.05$).

All cataract surgery procedures in both groups were performed under local, topical (Alcaine drops and 2% Lidocaine gel) and intra-cameral (1% Lidocaine solution) anaesthesia by two experienced surgeons (A.S. and W.O.). In all cases, pupils were dilated preoperatively using Tropicamide and Neo-Syneprine. Non-steroid anti-inflammatory eye drops were also instilled preoperatively.

Both C-MICS surgery and standard phacoemulsification were performed using Bausch & Lomb Stellaris machine. In all cases 2% hydroxypropyl-methylcellulose (Celoftal, Alcon) was used as an ocular viscoelastic device (OVD) and balanced salt solution (BSS) was used as the infusion fluid. In both groups the „stop and chop” technique and burst mode of phacoemulsification were used in all cases.

The exclusion criteria were: previous intra-ocular surgery, history of ocular trauma, coexisting ocular disease (e.g. glau-

coma, uveitis, retinal diseases), and endothelial cell density below 1500/ mm². All patients were examined preoperatively and on the first postoperative day.

In C-MICS group a self-sealing 1.8 mm wide clear corneal incision was created temporally. Continuous curvilinear capsulorhexis was done with micro-forceps under the OVD protection. Two side-ports were created with a 20 gauge MVR blade in the clear cornea 90 degrees away from the main incision for the chopper and aspiration/irrigation tips. Subsequently, phacoemulsification and aspiration were performed and a single-piece acrylic foldable IOL (MI60®, Bausch & Lomb) was implanted with an injector through the main incision in a wound assisted manner (5).

Similarly, in the standard phacoemulsification group, a self-sealing 2.75 mm wide clear corneal incision was created temporally. Continuous curvilinear capsulorhexis was performed with Utrata forceps under the OVD protection. Two side-ports were created in the same manner as in the C-MICS group. Next, phacoemulsification and aspiration were performed and a single-piece acrylic foldable IOL (Akreos Adapt AO®, Bausch & Lomb) was implanted with an injector through the main incision.

The non-parametric tests were used for the statistical analysis. Changes of pre- and postoperative values in the same group were compared using Wilcoxon signed-ranks test and statistical significance between two groups was determined using the Mann-Whitney U test. The α of 0.05 was considered statistically significant, and all calculations were performed using Microsoft Excel and Addinsoft XLStat 2008 software.

Results

No anterior segment abnormalities other than cataract were shown in the eyes in both groups of patients. Similarly, dilated fundus examination, in cases where the evaluation of posterior segment was possible, did not reveal any abnormalities. The intraocular pressure ranged between 12 and 20 mm Hg in all cases.

The mean preoperative distance UCVA was 0.32 ± 0.24 in Group 1 and 0.22 ± 0.21 in Group 2 (Tab. I), and the mean preoperative distance BCVA was 0.45 ± 0.25 in Group 1 and 0.34 ± 0.25 in Group 2. (Tab. II). Although small, these differences were statistically significant. This can be attributed to a higher number of cases of posterior subcapsular cataracts in Group 2 compared to Group 1. Mean LOCS III values were similar in both groups.

Postoperatively, the mean distance UCVA increased to 0.88 ± 0.18 in the study group and 0.79 ± 0.26 in the reference group (Tab. I). The difference was statistically significant. The post-operative mean distance BCVA was also significantly better (0.92 ± 0.16) in Group 1 than in Group 2 (0.85 ± 0.22) (Tab. II).

The very good (1.0) distance UCVA was achieved in 78 eyes (60%) in Group 1 and in 49 eyes (40%) in Group 2. In both groups a statistically significant postoperative improvement in mean UCVA and BCVA was observed. We found that there was a significant difference in the percentage of eyes with UCVA and BCVA above 0.5 between the groups, with a higher percentage in group 1 (Fig. 1).

There was a difference in the mean postoperative UCVA and BCVA values between LOCS- matched groups which was the most visible between LOCS 1–2 and LOCS 5–6 groups, where

| | C-MICS pre-op. | C-MICS post-op. | St. Phaco pre-op. | St. Phaco post-op. |
|------------------------------|----------------|-----------------|-------------------|--------------------|
| Minimum | 0.010 | 0.300 | 0.001 | 0.001 |
| Maximum | 0.900 | 1.000 | 0.800 | 1.000 |
| Median | 0.300 | 1.000 | 0.100 | 0.900 |
| Mean/ śr. | 0.323 | 0.885 | 0.225 | 0.789 |
| Variance | 0.057 | 0.031 | 0.046 | 0.067 |
| Standard deviation/ odch.st. | 0.239 | 0.177 | 0.214 | 0.258 |

Tab. I. Pre- and postoperative uncorrected distance visual acuity (UCVA).

Tab. I. Przed- i pooperacyjna nieskorygowana ostrość wzroku.

| Statistic | C-MICS pre-op. | C-MICS post-op. | St. Phaco pre-op. | St. Phaco post-op. |
|------------------------------|----------------|-----------------|-------------------|--------------------|
| Minimum | 0.010 | 0.300 | 0.010 | 0.080 |
| Maximum | 1.000 | 1.000 | 0.900 | 1.000 |
| Median | 0.500 | 1.000 | 0.300 | 1.000 |
| Mean/ śr | 0.454 | 0.920 | 0.345 | 0.846 |
| Variance | 0.064 | 0.027 | 0.064 | 0.050 |
| Standard deviation/ odch.st. | 0.254 | 0.165 | 0.254 | 0.224 |

Tab. II. Pre- and postoperative best corrected distance visual acuity (BCVA).

Tab. II. Przed- i pooperacyjna najlepiej skorygowana ostrość wzroku.

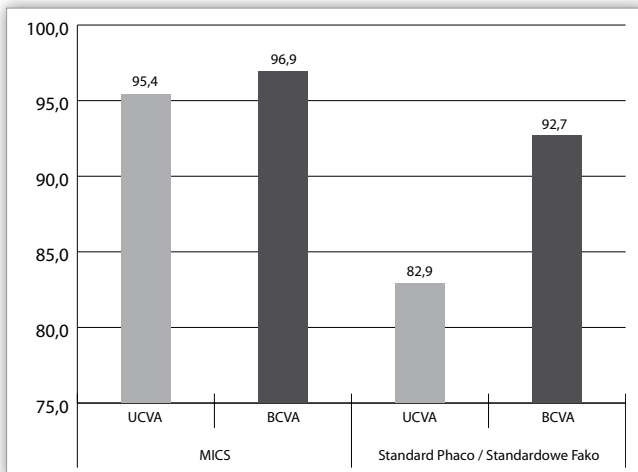


Fig. 1. Percentage of eyes with visual acuity over than 0.5.

Ryc. 1. Odsetek oczu z ostrością wzroku lepszą niż 0,5.

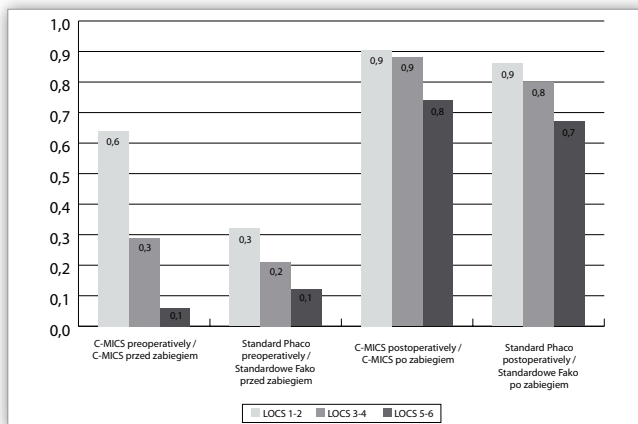


Fig. 2. Mean UCVA values according to LOCS scale.

Ryc. 2. Średnia nieskorygowana ostrość wzroku w zależności od skali LOCS.

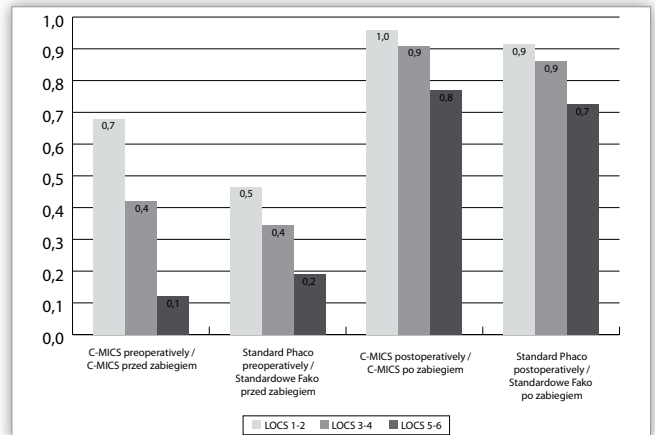


Fig. 3. Mean BCVA values according to LOCS scale.

Ryc. 3. Średnia najlepiej skorygowana ostrość wzroku w zależności od skali LOCS.

the results were worse. The difference was statistically significant in the study group and in the control group (Fig. 2, 3).

The mean postoperative UCVA and BCVA results in eyes with medium and hard cataracts (LOCS 3–4, LOCS 5–6) were slightly higher in Group 1 than in Group 2, but these differences were not statistically significant (Fig. 2, 3).

The post-operative complications were rare and transient. A minor corneal edema appeared in 11% and 6.5% of eyes from Groups 1 and 2, respectively. Likewise, Descemet’s membrane folds were observed in 11.5% of eyes in Group 1, and 13% of eyes in Group 2.

Discussion

Micro-incision cataract surgery has gained many supporters over the last few years. Several authors compared functional results of MICS and standard small incision phacoemulsification. They reported that MICS, compared to standard small in-

cision phacoemulsification, reduces the risk of corneal edema and loss of corneal endothelial cells. These authors also emphasized that MICS technique minimizes surgical trauma and virtually eliminates surgically induced astigmatism, resulting in good early UCVA, fast visual rehabilitation and the improved ultimate visual outcomes (7–12).

Lyle et al. (9) measured early postoperative UCVA after phacoemulsification performed through the 3.25 mm clear corneal incision. The UCVA of 0.5 or better was achieved in 38% of eyes at 30 minutes after surgery and in 52% of eyes on the first postoperative day. Eighty-nine percent of eyes had UCVA of at least 0.5 three months after surgery.

Osher et al. (13) measured UCVA on the first postoperative day and at 5 weeks postoperatively, in eyes after a small incision phacoemulsification with AcrySof (Alcon) IOL implantation. They reported UCVA of 20/40 or better in 98% of eyes on the first postoperative day and in 97% of eyes at 5 weeks. The authors suggest that early postoperative UCVA can be an excellent tool for the assessment of the new surgical techniques as it is more sensitive than the best corrected visual acuity.

The mean UCVA after MICS on Day 1 varies in different studies from 0.4 to 0.9 (4, 7, 14).

Wilczyńska et al. (14) analyzed the early and ultimate UCVA in eyes after phacoemulsification performed through different incision types. The mean UCVA on the first postoperative day in eyes after MICS was 0.73 and over 0.5 in 97.7% of eyes. The authors claimed that the early UCVA is a better prognostic factor of the ultimate functional outcomes in cases where small clear corneal incision or MICS was performed as compared to 3.75 mm scleral tunnel incision.

Some studies showed that the difference in the early postoperative UCVA between the biaxial micro-incision (B-MICS) technique and standard phacoemulsification through a small clear corneal incision is not significant (4, 7, 13). On the other hand, Dick (8) reported better early UCVA after B-MICS than after standard coaxial small incision phacoemulsification.

In our study, we have also observed significant difference between mean early postoperative UCVA after C-MICS (0.88 ± 0.24) versus standard small incision phacoemulsification (0.79 ± 0.26), and we have obtained early UCVA over 0.5 in 95.4% of eyes.

Conclusions

The early visual acuity results of C-MICS were better than the results of standard small incision phacoemulsification. As far as the fast visual rehabilitation after MICS is concerned, the early postoperative UCVA should be considered as an important yardstick in measuring success in cataract surgery.

These results are due to the MICS surgical technique, which is minimally invasive and should be considered a procedure of choice nowadays.

The study was supported by the grant 503-112-0 (503-01) and 502-03/1-007-02/502-14-017 of Medical University of Lodz.

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The study was originally received 01.06.2013 (889641)/
Praca wpłynęła do Redakcji 01.06.2013 (889641)
Accepted for publication 10.02.2014 /
Zakwalifikowano do druku 10.02.2014 r.

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